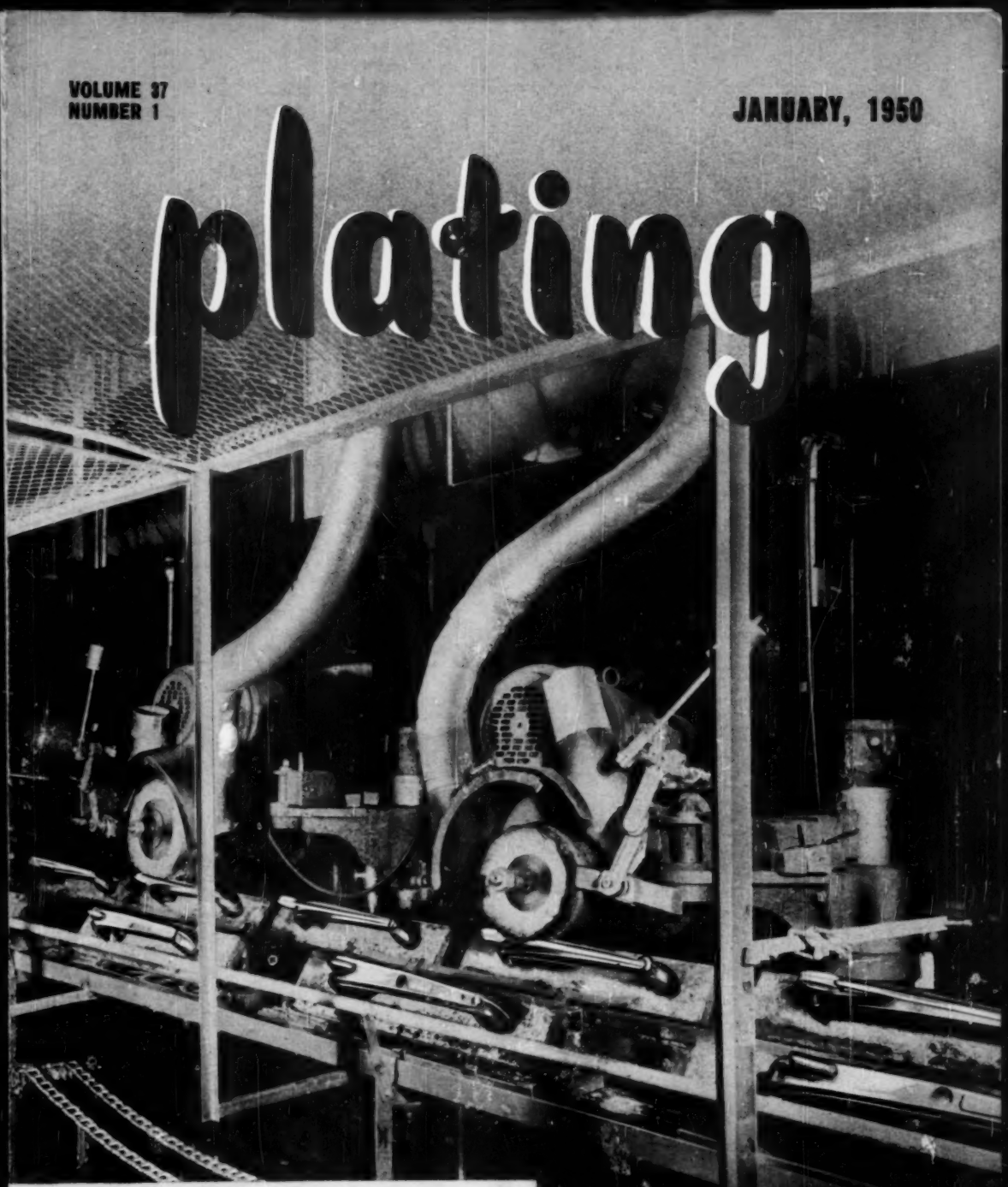
VOLUME 37
NUMBER 1

JANUARY, 1950

plating



LARGE SCALE FINISHING OF DIECASTINGS

See Contents Page 33

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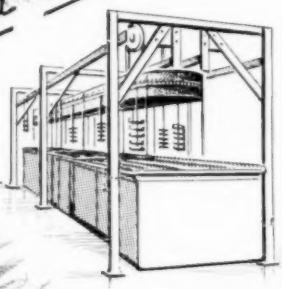
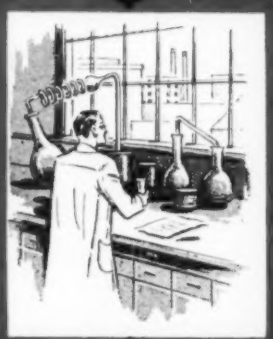
Automatic —
PLATING CONVEYORS

Require Specialized Cleaner Formulations





Our Laboratories have developed many special CLEPO Compounds to fit individual applications.

For example, we have developed specialized compounds and cleaning cycles which are very resistant to chromic acid contamination.

Have one of our engineers make a survey of your present cleaning methods at no cost to you.

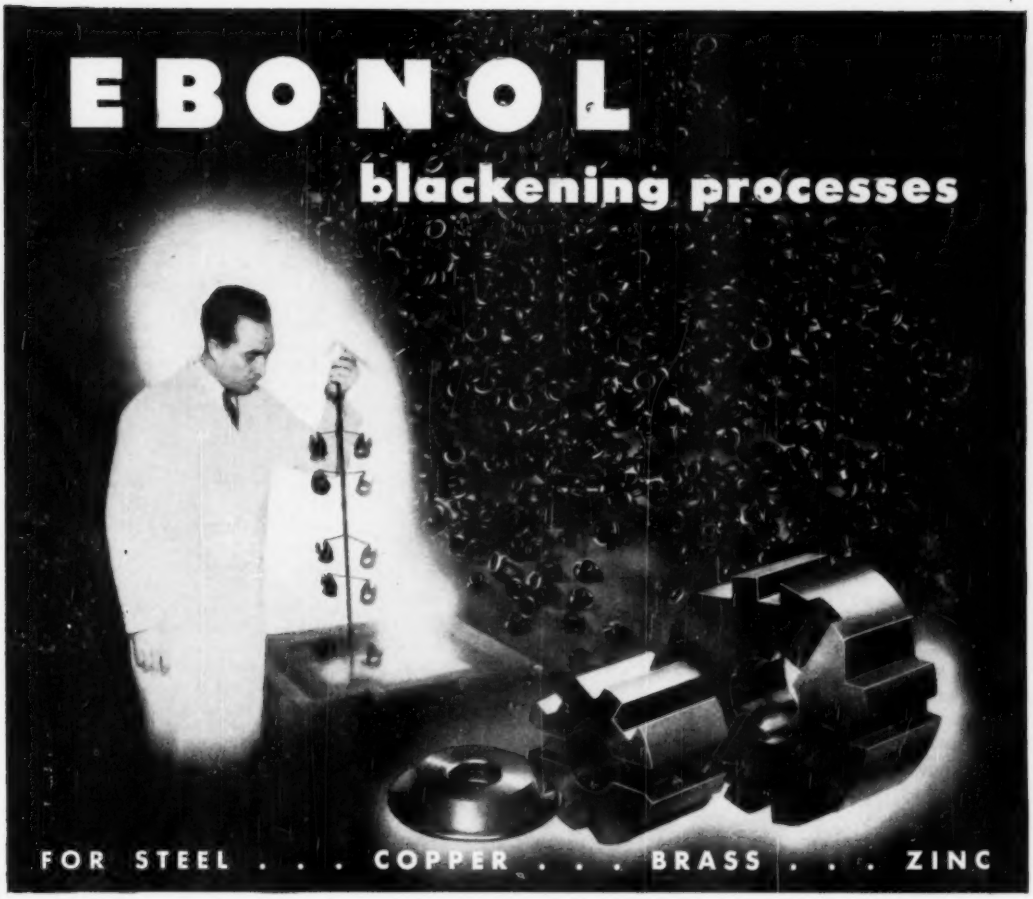
FREDERICK **GUMM** *Chemical Company Inc.*

538-542 Forest St., Kearny, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1.

EBONOL

blackening processes



FOR STEEL . . . COPPER . . . BRASS . . . ZINC

Enthone Ebonols today give new beauty, increased wearability and better functional qualities to hundreds of metal products.

The field is widely diversified: metal screens, cameras, business machines, machine tools, buttons, nameplates, dress trimmings, compacts, automobile hardware and accessories, etc.

EBONOL-C. (U. S. Patent 2,364,993) This is the best method of blackening and coloring copper and its alloys. Durable black cupric oxide is produced in a simple solution. Any metal that can be copper plated can also take this finish.

EBONOL-S. A one-bath method of blackening steel. Temperature 285 to 290° F. Simple to use and pleasant to run.

EBONOL-Z. A simple process for blackening zinc plate and zinc base diecastings. Beautiful glossy or dull finishes are achieved at low cost and trouble-free operation.

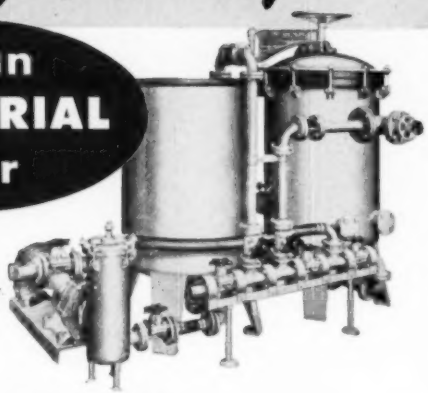
NEW TUMBLING TECHNIQUES are available for blackening and coloring. Send samples for free finishing demonstrations together with advice of experienced research chemists. *Write for new literature with procedures.*

ENTHONE

ENTHONE INC., 442 Elm Street, New Haven, Conn.

For Any Plating Solution
Any Quantity

use an INDUSTRIAL Filter



100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

You save many ways . . .

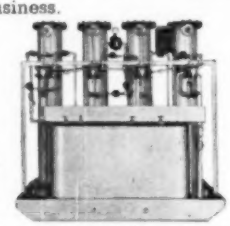
Here's how Industrial filters keep down the cost of plating jobs—The flow rates of Industrial filters are based on the actual plating solutions involved. You know the capacity you get. In the filtration of plating solutions there is more than just the filter. With Industrial you get an adequate filter with slurry tank, motor driven pump, valves and fittings in a complete package with one, undivided, experienced responsibility—with space requirements at a minimum.

The labor, down time, and the inconveniences of cleaning, replacing the filter media, and reassembling the filter for every new filter cycle—all are eliminated by the Industrial Air-Wash Cleaning Method available for all models. It is necessary to remove the cover only when new filter cloths are installed. With Industrial filters, a clarified plating solution is always assured.

The engineering, design, and construction of Industrial filters have proved out in long service and low maintenance costs. Industrial has the experience and is large enough to handle your filter requirements. Since 1927 filters and filtration systems have been an important part of our business.

INDUSTRIAL Water Demineralizers

for **No stains after hot rinse. No unwanted precipitates in solutions.**



A four-bed Industrial Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity · RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

INDUSTRIAL FILTER & PUMP MFG. CO.

1635 West Carroll Avenue
Chicago 12, Illinois

Industry News

Physical Science Internships at the National Bureau of Standards. Excellent opportunities now exist for outstanding students in science and engineering to broaden their undergraduate or graduate training through vacation-time employment or graduate fellowships offered by the National Bureau of Standards. The Bureau has established an integrated work-study program, beginning at the college-sophomore level, for the selection and training of its research scientists and engineers. This program permits the student to alternate periods of full-time study with actual work experience in his chosen field, supplemented by on-the-job training and orientation courses at the Bureau. At the same time it enables the Bureau to select promising students, upon graduation, for permanent appointment to its staff and to provide them with opportunities for professional growth and advancement through further in-service training.

Information regarding qualifications for appointment may be obtained from the Personnel Division, National Bureau of Standards, Washington 25, D. C.

Wyandotte Chemicals 25-Year Watch Award Winners. The total of Wyandotte Chemicals employees who have received gold watches as an award for completing 25 years of service has now reached 1,440—with 855 of them still in active company service.

Shown here watching the birdie with Carter B. Robinson, Vice-President of the J. B. Ford Division and a watch award winner in 1942, are a few of the latest winners. Seated, left to right: W. H. Trotter, Montreal; Perk Spencer, Sales Manager, Pacific Division; Mr. Robinson; and Harry Rightmire, a veteran Ford Division sales manager; standing: Carl Hattendorf, Cleveland; Danny Danenhower, Columbus; Clyde Craven, Grand Rapids; W. J. Day and Frank Blake, both of Buffalo.

The watch presentation was made at a

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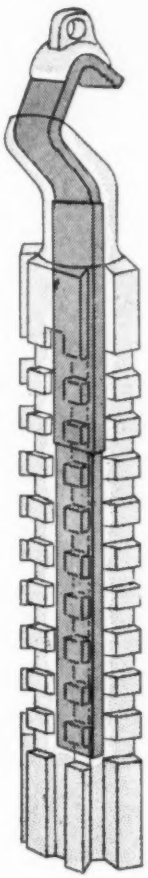
WE AGAIN REPEAT–

World's Finest Anode for Chromium Plating

A trial order will prove this!



HARTZELL

"COPPER CORE"

Chromium Anode

- **This Anode** will conduct 250 amperes based on copper area alone.

  Natural flow of current to parallel edges makes entire surface self-cleaning, insuring complete saturation, instant distribution of current, and unusual throwing power. Greatly reduces plating time for a given thickness of deposit.

- **"Copper Core"** distributes current equally throughout the entire length of anode.

  The copper core is insulated from the lead casing above and below the solution level—which prevents flow of heavy surface currents and burning off at solution line. Conductivity is uniform at all solution levels, regulated only by the cathode depth.

- **"Copper Core"** and point current construction aids in immediate coverage.

  A one-piece copper hook maintains perfect contact — no heating at point of contact, no current failures to solution. "Copper Core" Anodes do not warp out of shape.

The GILBERT TRAMER *Co.*

POLISHING • PLATING SUPPLIES • EQUIPMENT

402 SWETLAND BLDG., CLEVELAND 15, OHIO

Now you can get...
BETTER FINISHES, BROADER USAGE
for ZINC AND CADMIUM
with
IRIDITE
for

CORROSION RESISTANCE, PAINT ADHERENCE, FINAL FINISH... BRIGHT, CHROME-LIKE OR COLORED

The only complete line of patented chromate-dip treatments to meet your particular finishing problem.

Iridite *quality* is *tops* in corrosion resistance and paint bond. Iridite finishes are *first* in wide selection of coatings:

BRIGHT: Chrome-like in appearance

BRONZE: Natural as bronze itself

OLIVE GREEN: A popular replica of Military Olive Drab.

HUE BRITE: Clear; eye-appealing iridescence

COLORS: Black, Red, Blue, Green

PROCESS METHOD: Simple dip chemical immersion for a matter of seconds

SURFACES: Zinc or cadmium: plated, die cast, galvanized or sheet

COST: The smaller fraction of a penny does a square foot of surface

FREE—Write for literature and samples, and for immediate action, send us a sample of the product you wish to process, along with the outline of your problem.

SPECIAL PROCESSES—*Research and new developments in general metal finishing are being carried forward as manufacturers present new finishing problems for us to work out.* ***Let us go to work on yours.***

IRIDITE LICKED THESE FINISHING PROBLEMS—Washing Machine Parts • Radio Equipment • Kitchen Utensils • Aircraft Parts • Lock Hardware • Office Machines • Window Frames • Vending Machines • Tools • Lamp Fixtures • Fuel Pumps • Carburetors • Auto Hardware • Zinc Coated Sheet • Hinges, Screws, Bolts • Camera Parts • Plumbing Fixtures • Wall Panels • Refrigerator Parts • Wire Products • Instrument Parts • Electrical Equipment • Armed Forces Materiel.

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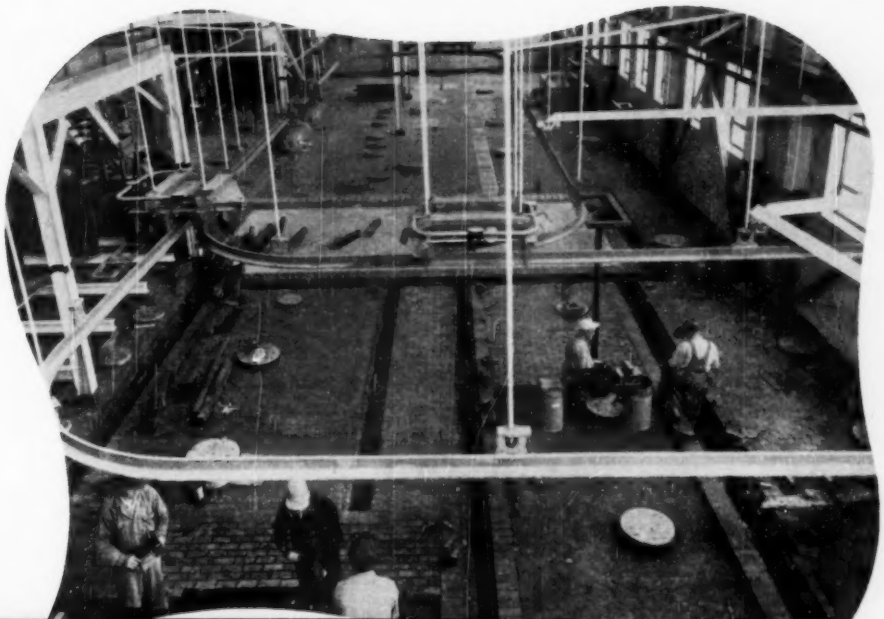


Picture of a Plant SAVING MONEY!

CHEMSTEEL Acid-Proof Installations Prevent Acid Damage in Modern Plating Plant . . . . .*

Men in the above plating room scene at a large electrical plant* are installing acid-alkali-proof, heavy-duty floors, trenches, manholes, sumps and mixing platforms. Skilled construction crews of Chemsteel Construction Co., Inc., working under direct supervision of Chemsteel engineers, they are providing complete protection from chromic, nitric, sulfuric and hydrochloric acids; cyanide and other corrosive salts.

Thus Chemsteel again enables an owner company to make sure that "down time" will be kept to a minimum . . . and that considerable savings will result in time, money and labor.

Such expectations are justified. Records of other plants using Chemsteel design, engineering and construction services include cases where production equipment lasted six times as long as that replaced, down time was reduced to half, and output was increased by more than 36%.

You, too, can profit from Chemsteel corrosion-proof construction. Backed by wide and varied experience serving major steel, chemical, textile and food plants, Chemsteel will design, select and obtain materials, and erect new corrosion-proof construction . . . handle maintenance work . . . or work cooperatively with your engineering firm or contractor in any one of these functions.

*Name on request

CHEMSTEEL CONSTRUCTION CO., INC.

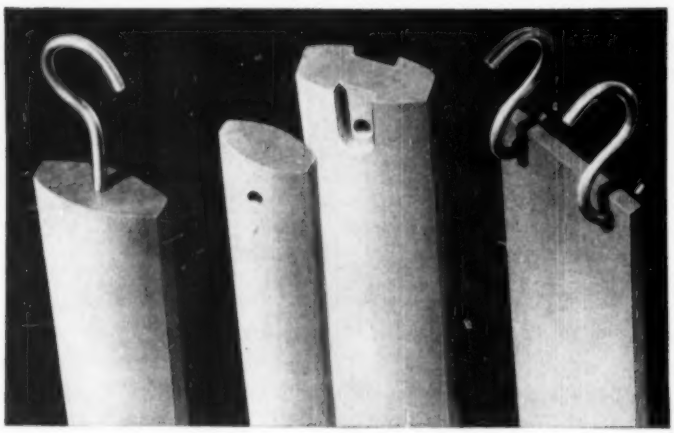
SPECIALISTS IN ACID-PROOF CONSTRUCTION

5428 Walnut St. Pittsburgh 32, Pa.

TELEPHONE: MUSEUM 1-7500

FOR COMPLETE DETAILS WRITE FOR BULLETIN A-6

ANACONDA
means purity in copper anodes



WHEN you specify ANACONDA, you are assured of unexcelled purity . . . less than 0.01 percent of total metallic impurities . . . an advantage that pays off five ways:

1. *Copper goes into solution faster and more uniformly.*
2. *The highest quality deposit is produced in the shortest possible time.*
3. *Slime is reduced to an absolute minimum.*
4. *Spotting and discoloration of the deposit are minimized.*
5. *Scrap losses are exceptionally low.*

In addition to copper, ANACONDA Anodes are furnished in brass and bronze . . . rolled sheet or oval . . . cut to your own specifications or standard sizes . . . drilled or undrilled . . . with or without hooks—also copper "cathode-anodes". For present or future reference, write for Publication C-5, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

for Plating with Copper, Brass or Bronze

Use ANACONDA Anodes

Industry News

banquet attended by nearly 400 Wyandotte Chemicals personnel in the company's gymnasium at Wyandotte, Mich. At this time 73 watches were presented.

Water Pollution Control. The U. S. Public Health Service, of the Federal Security Agency, has divided the country into fourteen natural-river or drainage basins to carry out the nation-wide water-pollution control program required by the Water Pollution Control Act of 1948. Ten of these basins have already been established and chief basin engineers appointed to assist the States concerned in developing needed programs.

These activities fall under the Water Pollution Control Division which has recently instituted a Technical Services Branch under Louis S. Warrick as Senior Sanitary Engineer. It will work closely with interested Federal, State and local groups and integrate all technical and research aspects of the program.

An 11-man advisory board reviews policies and programs, and makes recommendations to the Surgeon General of the Public Health Service.

Fidelity Chemical Products Corporation, manufacturer of industrial metal-treating and cleaning compounds for all purposes, has moved to larger quarters at 470 Frelinghuysen Avenue, Newark, N. J.

The 15,000 sq.ft. new plant houses many new facilities: a pilot plating plant, model spray booths, a technical library, and greatly increased production facilities for all types of alkaline cleaners, spray-booth compounds, paint strippers, and plastic peelable coatings.

Porcelain Enamel Spray Finishing Course. Binks Manufacturing Company, Chicago, is offering a one-week course in porcelain-enamel spray finishing, beginning February 6. Instructors will include authorities in both ceramics and ceramic-finishing equipment. Arrangements have been made with the Ferro Enamel Company to have one of its experts, Mr. E. E. Bryant, on hand to answer questions on porcelain enamel and porcelain-enamel shop procedures.

Classes are conducted without charge, and applications should be mailed at once to Mr. E. F. Watts, Binks Manufacturing Company, 3122 Carroll Avenue, Chicago 12, Ill.

First United States International Trade Fair will be held in Chicago on August 7–19. The purpose of the Fair is to provide an economical and productive medium for the sellers of the world's goods to open the American market. It will be the first time in history that foreign producers will be able to meet a concentra-

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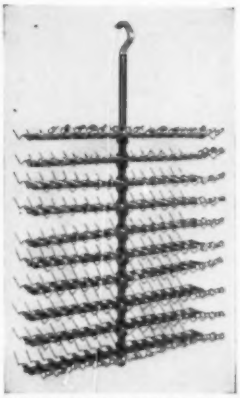


ONE RACK OR A THOUSAND

CALL HEADQUARTERS!

FOR

STANDARD RACKS and PARTS

WE WILL DESIGN RACKS FOR EVERY REQUIREMENT. LET US SOLVE YOUR PROBLEM AS WE HAVE FOR MANY LARGE AND SMALL MANUFACTURERS IN THE PLATING INDUSTRY.

A COMPLETE PLATING RACK SERVICE

A complete, engineered rack designed specifically for your work—or, the same standardized, interchangeable parts and materials, for those who build their own, are available at *Standard* in any quantity. When you buy *Standard* you buy *experience!* Couple this with our modern, fully-equipped plant, which is devoted exclusively to the manufacture of plating racks and parts, and you have the key to our recognized leadership in this field.

Excellent evidence of our leadership and aggressive research is our Stand-it-All Insulation. Flexible and tough! When bonded to the rack, it prevents plating up of the rack, saves current, plating material—*and the rack.*

COPPER AND WIRE AT TODAY'S WAREHOUSE PRICES

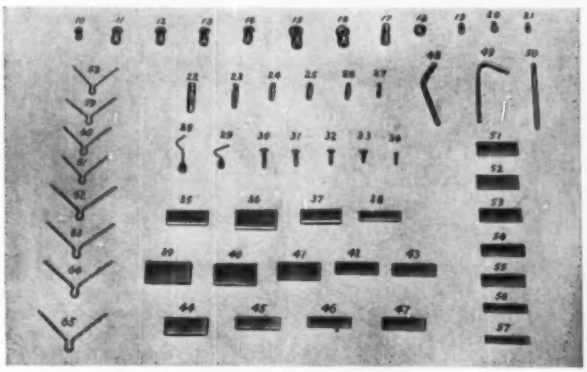
RACK INSULATION:
Quality and Service

INSULATING MATERIALS:
Stand-it-all Plastisol
Stand-it-all Neoprene
Stand-it-all XXX

PARTS:
Studs, brackets, bending jigs, tips, round edge copper, phosphor bronze wire, and aluminum.

RACK REPAIR KITS:

Write for Parts Catalog and Prices.



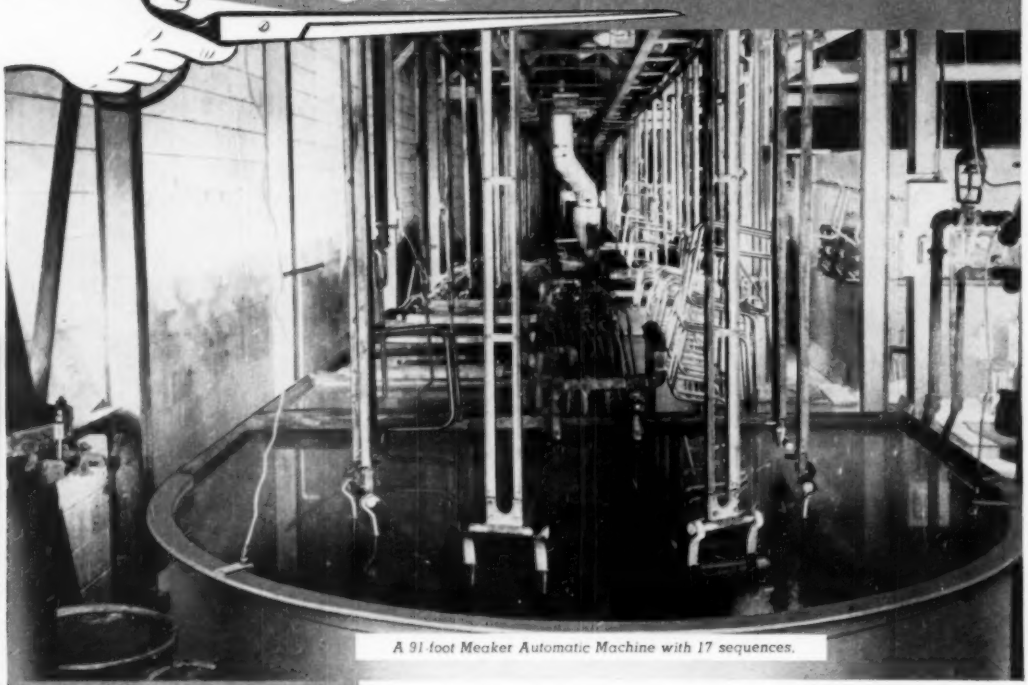
ONE PART OR A CARLOAD

"RACKS IS OUR BUSINESS"

STANDARD PLATING RACK COMPANY

1913-25 N. PAULINA STREET CHICAGO 22, ILL.

WANT TO *Cut* PLATING COSTS?



A 91-foot Meaker Automatic Machine with 17 sequences.

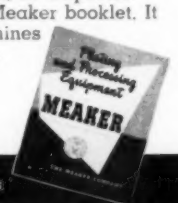
Get Results

with a MEAKER PLATING MACHINE

You save three ways with a Meaker plating machine. In many cases the savings in labor costs, space, and chemicals alone have paid for the Meaker equipment in a very short time. Increased production is a natural result. A better and more uniform plating job is assured. Furthermore, cleaner and more agreeable working conditions reduce personnel turnover to a minimum.

A Meaker machine makes every operation in the plating sequence automatic, or as mechanized as possible. It is the profitable way to do electroplating on a competitive basis. Large percentage savings have been the rule both in the plating departments with medium output and in the mass production plants.

Look to the handling methods in your plating work. There may be an opportunity to save a lot of money. Whatever your requirements call for—full automatic, semi-automatic, or a special machine—Meaker has the answer. Get the Meaker booklet. It shows actual installation photographs of machines that have reduced operating costs for others—these machines can do the same for you.



Ask for Booklet No. 148

MEAKER PRODUCTS

Serving the Plating Industry for over 50 Years

THE MEAKER COMPANY

1639 South 55th Avenue, Chicago 50, Illinois, Telephone CRawford 7-7202

Cowles

KW

HIGH SPEED ALKALINE CLEANER

• Cowles KW is a fast, efficient and economical cleaner for cleaning steel, die castings, polished and unpolished brass, copper and bronze. It may be used in still tanks with or without electric current and also in all types of washing machine equipment. Cowles KW does not attack the metal.

Adaptable with Cowles KW Cleaner are Cowles emulsion type cleaners, SK and LIXOL. These combinations are excellent for pre-soak cleaning and ideal for preparing steel for enameling.

Immediate shipment from warehouse stocks.

Cowles
TECHNICAL SERVICE
ON REQUEST

Cowles Chemical Company

METAL CLEANER DEPARTMENT • CLEVELAND 3, OHIO

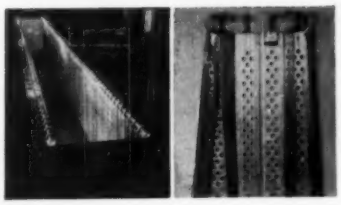
More utility per dollar

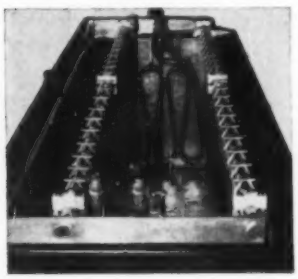
in

STORTS ANODES

For Cleaning

Shown at right is an electric cleaner tank equipped with STORTS Perforated Steel Anodes, and a group of these anodes. The dozens of edges provided by the perforations act as distributing points for the current. Ruggedly built for long wear, these anodes handle easily and clean easily.





For Plating

STORTS Perforated Lead Anodes are shown here installed in a chrome plating tank. Further refinements in Storts anode design include a wide range of anode hooks for various requirements and heavily reinforced lead welds used in the assembly. Stortsdesigned anodes have been proving their superiority in service for more than twenty years.

Is your anode problem different?

Special requirements are a STORTS specialty. Anodes to go around your work, inside your work or below your work can be fabricated especially to suit your individual needs. For an introduction to better anode performance —standard or special—write for a copy of STORTS Anode and Hook Specifications.

STORTS WELDING COMPANY
INCORPORATED

42 Stone Street Meriden, Conn.

Manufacturers of Welded Fabrications to Specifications

Industry News

tion of American buyers. However, American manufacturers are also participating, and foreign buyers will be on hand.

Exhibits have been classified into twenty-nine categories of products, and space will be assigned according to classification and not by national origin. They will be housed in four permanent exposition halls: Navy Pier, International Amphitheatre, Coliseum and Arena.

The registration fee has been set at $10.00. This will include not only free transportation between halls but also the complete catalog of exhibitors and products on display. Hours for buyers and business visitors will be from 9:00 A. M. to 6:00 P. M. each day. Products on display will include both industrial goods and consumer items.

Response has been heavy from both American and foreign firms and governments. All space allotted to American firms is expected to be taken by January 15, and foreign exhibitors are expected to fill their quota not too long after. Space assignments are being made in the order of the receipt of applications. Information about space and cost may be had from headquarters, 10136 Merchandise Mart, Chicago 54, Ill.

Market Trends. According to Price Guide No. 497, effective November 23, 1949, issued by The Udylite Corporation, Detroit 11, Mich., zinc anodes advanced ½ cent, copper anodes 7/8-1 cent and copper cyanide 1½ cents per pound. Comparative price indexes for general chemicals was 217.7 against 233.5 a year earlier and 100 on August 1, 1914, and for acids 121.8 against 123.3 and 100, respectively.

Spray Painting Courses for Industrial Refinishers. Five intensive one-week courses for industrial finishers are included in the De Vilbiss School of Spray Painting curriculum for the first half of 1950. Maintained as a service to all users of De Vilbiss equipment, these tuition-free courses include comprehensive instruction on all spray painting techniques and the function and care of spray equipment.

Classes lasting one week each will begin on January 23, March 27, April 17, May 8, and June 19, with all courses covering the same subject matter. For further information and application blanks, write for Forms F-224 and INS-753-A. Since class size is necessarily limited, it is advisable to make reservations as early as possible to The De Vilbiss Company, 300 Phillips Avenue, Toledo 1, Ohio.

Cowles Chemical Company announces the removal of its research and development laboratories from Syracuse University to new and larger quarters at 105 S. Townsend Street, Syracuse 2, N. Y.

WORLD-FAMOUS SCHWINN-BUILT BIKES are known for high-quality workmanship. 3M Abrasive Belts give superior finish to frame members, other internal parts.

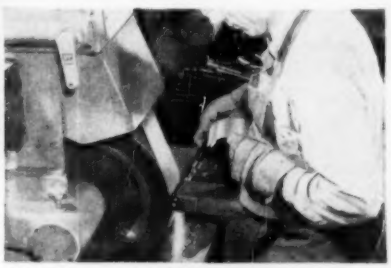
GROOVED BUFF CONTACT WHEEL permits easy polishing of contours on tough crank forgings. 3M Abrasive Belts give smoother finish in half the time of former methods.

Schwinn Saves $42,000!

Finishing costs cut 50% on just one of several belt grinding operations

Finishing costs on bicycle crank forgings dropped from 14¢ to 7¢ per unit when Arnold Schwinn & Co., America's largest bicycle manufacturer, converted to belt grinding. 3M Abrasive Belts give faster rough cutting, finer finishing, save $42,000 a year on this one operation alone.

3M Methods Engineers are trained to analyze your production problems in rough grinding or finishing of metals, wood, glass, or plastic. They can show *you* savings . . . increase the quality of your workmanship. Write today for complete information.



MAIL COUPON FOR FREE BOOKLET full of money-saving shortcuts for your grinding and finishing operations.

Address: Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

☐ Please send me a copy of your "Step Up Production" booklet.

☐ Please send a 3M Methods Engineer to call on us.

By.....

Firm.....

Address.....

City.....*Zone*.....*State*.....

F-150

3M ABRASIVE BELTS

Made in U.S.A. by **MINNESOTA MINING & MFG. CO.** St. Paul 6, Minn.
Also makers of "Scotch" Brand pressure-sensitive tapes, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives

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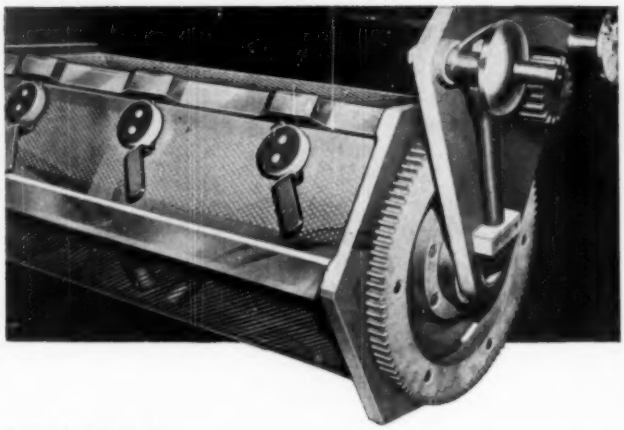
ONE LOADING

for Complete Cleaning and Plating Cycles



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Replaceable bushings for long life with low upkeep.

To modernize your plating barrels, BELKE High Temperature Lucite Cylinders can be furnished for any size and style of hanger.

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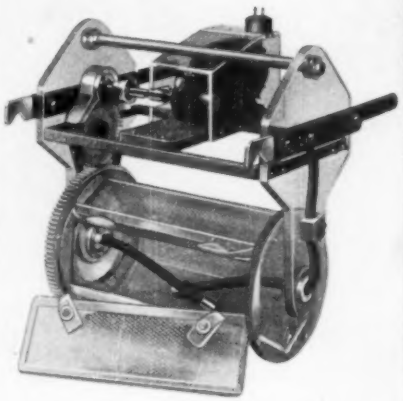

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Sets into any still plating tank. Easily transferred by hand — weight only 27 lbs. Capacity is approximately 2 quarts. Molded High Temperature Lucite Construction withstands all cleaning and plating cycles at temperatures to 185°F.

Fast and easy loading and unloading is afforded by clutch that starts and stops cylinder without shutting off motor.

Support arms of Porto-Plater rest across bus rods so cylinder hangs down into plating solution. Uninsulated notched end of support arms contact cathode rod to complete plating circuit. Operated by complete self-contained motor drive with plug connection.

For complete information, consult your BELKE Service Engineer — or write.

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It can mean *any* kind . . . unless you define the word *'quality"*.

Quality in plating can best be defined by specifications that cover plate thickness, adhesion, resistance to corrosion, and other important factors. You know that a finish which might be termed "high quality" for one use, may be inadequate for another.

That's why specifications are needed . . .

They should fully describe the protective armor for preserving the base metal under all conditions to which the article may be exposed.

Specifications offer another important advantage. They give to plater, to manufacturer, and to consumer . . . a common basis for evaluating finishes. This makes it easy to discuss the work *clearly*, with anybody, and come to a mutual understanding of exactly what is expected of the manufactured part.

That's why you should help your customers and prospects to order by adequate specifications . . . and make sure each one knows exactly what those specifications cover.

Send for your *free* copy of *"Practical* NICKEL PLATING". Filled with useful information, this booklet is yours for the asking. Write for it now.

EMBLEM OF SERVICE INCO

The International Nickel Company, Inc., Dept. P, 67 Wall St., New York 5, N. Y.

Please send me booklet entitled: Practical NICKEL PLATING

Name _____ *Title* _____

Company _____

Address _____

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Situation Open—Aggressive man, 26 to 32 years of age, with chemistry or chemical engineering background and some industrial experience in electroplating and metal finishing field. Position in general sales department work, plant layout, compiling proposals, quotations, etc. Some service and outside sales work as ability is developed, pointing, after sufficient training and experience, to sales engineering position. Midwest manufacturer, operating nationally. Write fully giving education and experience details including salary expected.

P-150B, PLATING
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Address reply to:

P-150D, PLATING
P. O. Box 168, Jenkintown, Pa.

Industry News

Federal Money for Plating Waste Study. The Public Health Service of the Federal Security Agency has recently made a provisional allotment of $12,900.00 to the Ohio Department of Health for studies of the toxicity of electroplating waste. This grant will be advanced after the application for funds has been reviewed and approved by the Surgeon General.

So far a total of $891,487.00 out of an available $1,000,000.00 has been granted to state and interstate agencies.

Preliminary comprehensive reports containing data on stream pollution conditions existing throughout the country are being developed by Public Health Service Engineers. When completed they will serve as the basis for programs of control.

Apothecaries Hall Century Old. Apothecaries Hall Company, Waterbury, Conn., celebrated its hundredth anniversary Saturday, October 29, at a banquet at the Hotel Elton, Waterbury.

Founded in 1849 by a group of physicians and businessmen as a drug store, it was very soon selling glass, white lead, industrial chemicals, and fertilizers. The company at present has several major divisions, including wholesale and retail drugs and paints, a foundry, a heavy-chemicals division, a well-staffed research laboratory, and a large plant engaged in the manufacture and distribution of fertilizers and insecticides. Products of the company's own manufacture also include industrial metal cleaners; nickel, copper, brass, cadmium and zinc anodes; and buffing compositions.

The company has always maintained an enviable record of service to the community, the State, and beyond. Two of its early officials were mayors of the city of Waterbury, one a town clerk, and one, comptroller of the State of Connecticut.

Noteworthy in the company's history is its relationship with the employees and the extraordinary length of service of many key people. The three senior officers, Isaac P. Kellogg, Chairman of the Board; Evan H. Jones, President; and Levi Wilcox, Secretary, have a total of 151 years of service with the company. Twenty-three employees received service emblems at Saturday's banquet indicating individual length of service of over twenty-five years. The company instituted one of the first noncontributory group-insurance policies over a generation ago. A liberal pension plan, which went into effect in 1947, recognizes the years of past service of the employees.

In keeping with the company's traditions, Saturday's celebration was a quiet family affair with only the mayor, two clergymen, and some two hundred and fifty employees and spouses in attendance. As it begins its second century, despite its years and the length of service of its employees, the company still displays the same vigor, aggressiveness and enthusiasm that marked the infant enterprise in 1849.

J. H. Overpeck Company New Azed Distributor. Azed, Inc., 851 S. Market Street, Waukegan, Ill., has recently appointed J. H. Overpeck Company, 1112 House Building, Pittsburgh, to distribute its line of detergents and accelerators for pickling baths, addition agents for galvanizing and zinc electroplating baths, and secondary treatments for zinc surfaces. The territory covered by the Overpeck organization will include western Pennsylvania, eastern Ohio and part of northern West Virginia.

SITUATION OPEN
ELECTROCHEMICAL ENGINEER

with at least five years of practical plating experience in laboratory and shop to supervise production in New Jersey plant. Good future assured the right man by progressive company.

Address reply to:

P-150E, PLATING
P. O. Box 168, Jenkintown, Pa.

WANTED
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A comparatively new company, which has an excellent line of buffing compounds, rouge, steel and lime bars, and wishes to establish national distribution, is seeking salesmen and jobbers. This company is currently selling its products to an impressive list of manufacturers in its own area. If interested address reply to:

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TOP FLIGHT MANUFACTURING AGENTS AND JOBBERS Wanted in certain territories to sell Schaffner's Buffing Compositions and Supplies. We specialize in White Finish (Lime, Compositions), Grease Stick, Tripoli, Emery Cake, etc., in "Bar or Liquid Form". All up to 100 per cent saponifiable. These items can all be made to fit your particular customers' requirements. No account is too small or too large for our individual attention.

SCHAFFNER MANUFACTURING COMPANY
Schaffner Building
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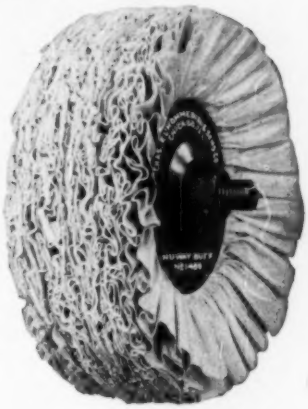

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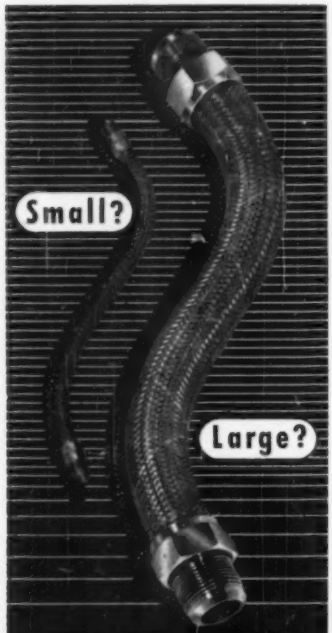

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Personals

Wilfred S. McKeon, President of Sulphur Products Company, Greensburg, Pa., is reported slowly convalescing from his recent illness. A victim of hypertension and high blood pressure, he was released from the hospital about eight weeks ago but is still under strict doctor's orders. His general health allows him on his job only a few hours each day.

Lawrence G. Gilmore, formerly President of Sylvania Plastics Company, Sylvania, Ohio, is now owner of Gilron Plastics, 6005 Secor Road, Toledo, Ohio. The latter company manufactures and develops plastic compounds.

Charles E. Crowley has recently been elected President of the Alsop Engineering Corporation of Milldale, Conn., at a special meeting of the directors. He succeeds the late Samuel Alsop, Sr. Mr. Crowley has been associated with the concern for twenty-seven years.

E. H. Bucy is now Sales Co-ordinator of the Sun Chemical Corporation, Long Island City 1, N. Y., for its divisions other than Graphic Arts. He was formerly General Manager of the Industrial Finishes Department of the Atlas Powder Company and has had many years experience in the protective coatings field.

Howard B. Downs has been promoted to the post of General Sales Manager of the Solventol Chemical Products Company, Detroit, Mich.

Fred G. Baker is now Director of Engineering and Design of The Electro Chemical Supply & Engineering Company, 750 Broad Street, Emmaus, Pa. Mr. Baker is a chemical engineer, graduate of the Iowa State College in 1940, and until recently a member of the Engineering Department of the E. I. duPont de Nemours & Company, Inc.

Foulke

Dr. D. Gardner Foulke has been advanced to Chief Chemist in charge of analysis and customer service by The Hanson-Van Winkle-Munning Company.

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1949 INDEX

Volume 36

AUTHOR INDEX

A

Anderson, E. A., *see* Graham, A. K.

B

Borchert, L. C. and R. B. Kinnaman
The Practical Significance of Good Power Transmission 456
Bowman, B. A.
Airplane Propeller Production 1228
Brenner, Abner and Seymour Senderoff
Calculation of Stress in Electrodeposits from the Curvature of a Plated Strip 810
Burkhead, P., *see* Serfass, Earl J.

C

Caldwell, M. R., *see* Sperry, L. B.

D

Davis, R. M., *see* Serfass, Earl J.
Diggin, Myron B.
A Modern Electroplating Laboratory 38
Dodge, Barnett F. and D. C. Reams
Disposal of Plating Room Wastes. I. Critical Review of the Literature Pertaining to the Disposal of Waste Cyanide Solutions 463, 571, 723, 827
———, *see* Gurnham, Fred C.
Du Rose, A. H., *see* Willson, K. S.

E

Ewing, D. T. and W. D. Gordon
The Effect of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. 2. Correlated Abstract and Critical Review 58
———, Robert J. Rominski and William M. King
The Effect of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. 3. Purification of Solutions, Methods of Operations, and Testing of Deposits 1137

G

Gebert, N. J. and M. M. Roberts
Manufacture of Tire Chains 349
Gordon, W. D., *see* Ewing, D. T.
Graham, A. Kenneth
The Chemistry of Copper-Zinc Alloy Plating Baths 1120
———, *see* Kelch, James L.
———, S. Heiman and H. L. Pinkerton
Deposition of Precious Metal Alloys 47, 148
———, H. L. Pinkerton, E. A. Anderson and C. E. Reinhard
The Plating of Pressed Metal Powder Parts 702
Gurnham, C. Fred
Waste Disposal Studies 151
———, Barnett F. Dodge and D. C. Reams
Preliminary Planning for Plating Room Waste Disposal 1136

H

Harrold, Gordon C.
Water Pollution from Electroplating Operations 919, 1204
Haslem, M. E., *see* Zapffe, C. A.
Heiman, S., *see* Graham, A. K.
Hirsch, Albert
High Speed Automatic Nickel Plating, with Notes on Rainbow in Chromium Plating and Electropolishing of S. A. E. 1010 Steel 138
Hogaboom, George B.
Copper in Silver Strike Deposits 22
Patent Abstracts 76, 172, 269, 376, 480, 622, 741, 836, 939, 1050, 1154, 1256

J

Johnston, Samuel S.
A Brief History of Tin Plate 711
Electrolytic Tin Plate, Its Production and Benefits 1233
——— and Jones, J. A.
Electrolytic Tin Plate 712
Jones, J. A., *see* Johnston, Samuel S.

K

Keeler, James H., *see* Smith, William
Kelch, James L. and A. K. Graham
Electrometric System for Continuous Control of Hexavalent Chromium in Plant Wastes 1028
Kelemen, Denis, *see* Thon, N.
King, William M., *see* Ewing, D. T.
Kinnaman, R. B., *see* Borchert, L. C.
Klatka, Fred H., *see* Savage, Frank K.
Kushner, Joseph B.
Rinsing 798, 915, 1110, 1130, 1202

L

Ledford, R. F.
Cobalt-Nickel Deposition in Electrotyping 560
Levine, W. S., *see* Serfass, Earl J.
Ling Yang, *see* Thon, N.
Logozzo, Arthur W.
Plating of Bright Nickel and Decorative Chromium without Reracking 567

M

Matlock, Robert C.
Copper in Silver Strike Deposits 22

McDaniel, J. S.
A Designer Looks at Electroplating 234
Miller, Paul E.
An Incentive Plan for Job Shop Plating 56, 234

N

Nixon, C. F.
A Plater's View of Designing 235

O

Oyler, R. W.
Disposal of Waste Cyanides by Electrolytic Oxidation 341

P

Parker, Edward A.
Barrel Gold Plating 448, 744
Perry, M. H., *see* Serfass, Earl J.
Pinkerton, H. L., *see* Graham, A. Kenneth
Prang, P. J., *see* Serfass, Earl J.
Prater, Thomas A. and Harold J. Read
The Strength and Ductility of Electrodeposited Metals. I. The Hydraulic Bulge Test 1221

R

Read, Harold J.
Book Reviews 65, 167, 265, 369, 472, 736, 830, 934, 1041, 1148, 1246
———, *see* Prater, Thomas A. *and* Smith, William
Reams, D. C., *see* Dodge, Barnett, F. *and* Gurnham, C. Fred
Reinhard, C. E., *see* Graham, A. K.
Roberts, A. M., *see* Gebert, N. J.
Rochat, R. J.
Rapid Determination of Gold in Cyanide Baths 817
Rominski, Robert J., *see* Gurnham, C. Fred

S

Saltonstall, R. B.
Maintenance in the Plating Room 34, 226
Trouble Shooting in the Plating Room 1216
Savage, Frank K. and Fred H. Klatka
Manufacture (plating) of Tubular Furniture 803
Schaefer, Ralph A.
Manufacturing Electroplated Bearings 452
Schneider, J. George
A Survey of Labor Costs in Chicago Job Shops 566
Schroeder, E. J.
Plating Generators 717
Senderoff, Seymour, *see* Brenner, Abner
Serfass, Earl J., W. S. Levine and R. M. Davis
Determination of Impurities in Electroplating Solutions. XI. Traces of Ammonium in Nickel Plating Baths 158
XII. Traces of Chromium in Nickel Plating Baths 254
———, W. S. Levine, P. J. Prang and M. H. Perry
XIII. Traces of Zinc in Nickel Plating Baths 818
———, W. S. Levine, R. M. Davis and M. H. Perry
XIV. Traces of Calcium in Nickel Plating Baths 1034
———, and P. Burkhead
XV. Traces of Silver in Copper Plating Baths 1237
Smith, William, James H. Keeler and Harold J. Read
Grain Orientation in Nickel Plate as Related to Brightness 355
Sperry, L. B. and M. R. Caldwell
Destruction of Cyanide Copper Solutions by Hot Electrolysis 343

T

Taylor, Albert D.
The Plating Step in Clad Steel Manufacture 239
Thon, N., Denis Kelemen and Ling Yang
Porosity of Electrodeposited Metals. IV. Measurement of Very Low Porosities by the Low Pressure-Constant Overpressure Method 362
V. Measurement of the Corrodibility of Metal Foils 928, 1145

W

Willson, K. S. and A. H. Du Rose
Smoothing Effects of Nickel Deposits 246

Z

Zapffe, C. A. and M. E. Haslem
Hydrogen Embrittlement in Copper Electroplating 906

SUBJECT INDEX

A

Abrasion resistance of zinc plate (Q)* 829
Abrasive Grain (Natural and Artificial), General Motors Standards for 1016
Adhesion, causes of poor 1217
Airplane Propeller Production (plating) 1229
Aluminum, cost of plating on (Q) 735
resist for anodized and dyed (Q) 1147
Article Abstracts 66, 170, 266, 372, 476, 618, 738, 832, 936, 1044, 1149, 1250
Automatic plating conveyors, maintenance of 36

B

Barrel burnishing, cleaning after (Q) 475
of pressed-metal-powder parts 704
Barrel Gold Plating 448, 694, 744
Barrels, maintenance of plating 35
Bearings, Manufacturing Electroplated 452
Bipolarity in cleaning and plating 456
Bismuth-silver alloys, deposition of 49
Book Reviews 65, 167, 265, 369, 472, 736, 830, 934, 1041, 1148, 1246
Brass plating baths, chemistry of 1120

*(Q) refers to Question Box item.

Brass plating on cast iron (Q) 263
Brightness vs. grain orientation of nickel deposits 355
Britannia metal, resilvering of (Q) 63, 1043
"Bronze" plating baths, chemistry of 1120
Buffed nickel silver, cleaning of (Q) 475
Buffed zinc plate (Q) 169
Buffing and polishing, materials used in 1012, 1127
Buffing Compounds, General Motors Standards for 1130
Buffing of pressed-metal-powder parts 704
Buffs, General Motors Standards for Cotton 1013
Buffs, preparation of 1134
Burnishing, cleaning after barrel (Q) 475
of pressed-metal-powder parts 704
of stainless steel 132
Bus bars, maintenance of 35

C

Cadmium anodes, impurities in (Q) 1147
Cadmium plating, hydrogen embrittlement in 907
Cast iron, brass plating of (Q) 263
Cements, corrosion resistant 334
Chains, Manufacture of Auto Tire 349
Chromium plating, difficulties from stray currents in 458
hard 50
hydrogen embrittlement in 907
rainbow in 138
without reracking after nickel plating 567
Chromium Plating of Massive Objects is Big Business, Heavy 50
Chromium wastes, continuous control of reduction of 1028
Clad Steel Manufacture, The Plating Step in 239
Cleaning difficulties from stray currents 456
Cobalt-Nickel Deposition in Electrotyping 560
Cobalt-Nickel deposits, stress in 564
Copper cyanide solutions, disposal of 340
Copper deposits, corrodibility of 928
cracking and peeling of acid (Q) 735
penetration into pores by 709
stripping from heat treated steel of (Q) 1147
Copper electroforming of phonograph-record stampers (Q) 169
Copper Electroplating, Hydrogen Embrittlement in 906
Copper-lead-tin alloy plating of bearings 455
Copper Plating Baths, Determination of Traces of Silver in 1237
Copper-silver alloys, deposition of 49, 153
Copper-silver-platinum alloys, disposition of 49, 151
Copper-Zinc Alloy Plating Baths, The Chemistry of 1120
Corrodibility of electrolytic copper and nickel foils 928
Corronizing of wire screen 142
Corrosion resistance of plated parts, causes of poor 1220
Corrosion resistant cements 334
Cost of plating, labor 56, 439, 566
Cost of plating on aluminum (Q) 735
Cyanide wastes, disposal of 340, 463, 571, 723, 827

D

Degreasers, maintenance of 37
Design for Electroplating 234
Dragout and dragin 798, 915, 1110, 1130, 1202
Dragout on pressed-metal-powder parts 703
Ductility of electrodeposited metals, test for 1221

E

Electrodeposited Metals (test for), The Strength and Ductility of 1221
Electroforming of phonograph-record stampers, copper (Q) 169
Electroplating, *see* Plating *and* individual metals
Electropolishing of S. A. E. 1010 Steel 138
Electrotyping, Cobalt-Nickel Deposition in 560
Embrittlement in chromium plating, hydrogen (Q) 1043
Embrittlement in Copper (cadmium and chromium) Electroplating (and cathodic pickling), Hydrogen 906
Embrittlement in zinc plating of coil springs, hydrogen (Q) 371
Emery Cake, General Motors Standards for 1130
Etching of dials for silver plating (Q) 579
Exposure tests on nickel-chromium-plated pressed-metal-powder parts 707

F

Filters, maintenance of 37
Finishing Compounds, General Motors Standards for 1129
Finishing of holloware (Q) 1043
Finishing of pressed-metal-powder parts 703

G

Generators, maintenance of 35
Generators, Plating 711
Glue, General Motors Standards for Animal 1128
Gold-alloy plating 49, 150, 152, 153, 451, 932
Gold in Cyanide Baths, Rapid Determination of 817
Gold Plating, Barrel 448, 694, 744
Gold plating baths, analysis of 451, 817

H

Heating coils, glass 138
Hydrogen embrittlement, *see* Embrittlement

I

Impurities in copper plating solutions, determination of .. 1237
Impurities in nickel plating solutions, determination of 158, 254, 818, 1034, 1145
effects of 58
methods for study of effects of 1137
Incentive Plan for Job Shop Plating, An 56, 439
Inconel-clad steel, nickel plating in manufacture of 239
Iridium-silver alloys, deposition of 49

J

Job Shop Plating, An Incentive Plan for 56, 439
Job Shops, A Survey of Labor Costs in Chicago 566

L

Labor Costs in Chicago Job Shops, A Survey of 566
Laboratory, A Modern Electroplating 38
Lacquer, disposal of waste 920
Lacquered buffed zinc plate (Q) 169
Lead-tin alloys, silver plating on 932, 1043
Lead-tin-copper alloy plating on bearings 455

M

Maintenance in the Plating Room 34, 226
Motors, maintenance of 35

N

Nickel-chromium deposits on pressed-metal-powder parts, outdoor exposure tests on 707
Nickel-chromium deposits, resistance to high temperature of (Q) 1248
Nickel-chromium plating of tubular furniture 806
Nickel-Cobalt Deposition in Electrotyping 560
Nickel-cobalt deposits, stress in 564

Nickel deposits, brightness *vs.* grain orientation in 355
corrodibility of 928, 1145
crystal orientation *vs.* porosity of 366, 552
distribution on bent cathode of 1142
intentionally rough (Q) 169
passive 570
penetration into pores by 708
smoothing effects of 246
Nickel foil, porosity of wrought 366
Nickel-plated panels, A. S. T. M. salt-spray standards for 1142
Nickel plating barrel-burnished steel (Q) 475
Nickel plating, bright 567
Nickel plating difficulties from stray currents 456
Nickel plating in automatics, high-speed 138
Nickel plating in clad-steel manufacture 239
Nickel plating solutions, automatic *p*H control of 807
determination of traces of ammonium in 158
determination of traces of calcium in 1034
determination of traces of chromium in 254
determination of traces of iron in 1145
determination of traces of zinc in 818
effect of impurities in 58
high-chloride 138
methods for study of effect of impurities in 1137
selenium in (Q) 253
Nickel silver, cleaning of buffed (Q) 475, 1043
preparation for silver plating of (Q) 932, 1043
Nickel-zinc alloy plating 142

O

Orientation in Nickel Plate as Related to Brightness, Grain 355
Orientation in nickel plate vs. porosity, crystal 366
Osmium-silver alloys, deposition of 49
Outdoor-exposure tests on nickel-chromium-plated pressed-metal-powder parts 707

P

Palladium alloys, deposition of 49, 79, 151
Passivity of nickel plate in chromium plating 570
Patent Abstracts 76, 172, 269, 376, 480, 622, 741, 836, 939, 1050, 1154, 1256
Pewter, resilvering of (Q) 63, 1043
silver plating of (Q) 932
*p*H control of nickel solutions, automatic 807
Pitting, causes of 1218
Plant engineering, plating 459
Plating machines, maintenance of 36
Plating plant engineering 459
Plating Room, Maintenance in the 34, 461
Trouble Shooting in the 1216
Platinum and platinum alloy plating 49, 79, 150, 151
Polishing and Buffing, Materials Used in 1012, 1127
Polishing Compounds, General Motors Standards for 1130
Polishing Wheels, Setting Up 1020, 1133
reconditioning of 1132
Porosity of Electrodeposited metals, measurement of 362
Porosity of electrodeposited copper foil 928
of electrodeposited nickel foil 552, 928, 1145
of pressed-metal-powder parts 702
of wrought nickel foil 366
Precious Metal Alloys, Deposition of 47, 148
Pressed Metal Powder Parts, Plating of 702
Pumps, maintenance of 37
Propeller Production (plating), Airplane 1228

R

Rack coatings, testing of 568
Racking in nickel-chromium plating 567
Rectifiers, maintenance of 35
selenium, air- or oil-cooled 1248
Rheostats, maintenance of 35
Rhodium-silver alloys, deposition of 49
Rinsing 798, 915, 1110, 1130, 1202
Roughness, causes of plate 1219
Ruthenium-silver alloys, deposition of 49

S

Silver alloys, deposition of 49, 150
Silver deposition from halide solutions 47, 148
Silver plating of dials (Q) 579
of nickel silver (Q) 475, 932
of soft-soldered musical instruments (Q) 829
of tin-lead alloys (pewter) (Q) 932
Smoothing by nickel deposits 246
Soldered musical instruments, silver plating of soft 829
Spotting out on plated pressed-metal-powder parts, prevention of 706
Stainless-clad steel, nickel plating in manufacture of 239
Stainless steel, burnishing of 132
Stray currents in cleaning and plating, effects of 456
Streaks in deposits, causes of 1220
Stress in cobalt-nickel deposits 560
Stress in Electrodeposits from the Curvature of a Plated Strip, Calculation of 810
Stripping of copper deposits from heat-treated steel (Q) .. 1147
Structure *vs.* brightness of nickel deposits 355
vs. porosity of electrodeposits 522, 928, 1145

T

Tank heating, electric (Q) 63
Tanks, maintenance of 34
Temperature controls, maintenance of 37
Tensile strength of electrodeposited metals, test for 1221
Tin-copper-lead-alloy plating of bearings 455
Tin-lead alloys, silver plating of (Q) 932, 1043
Tin Plate, A Brief History of 711
Electrolytic 712
Its Production and Benefits, Electrolytic 1233
Tin plating baths, oxidants in stannate (Q) 263
Tin plating, electrolytic 923
Tripoli, General Motors Standards for 1129
Tubular Furniture, The Manufacture (plating) of 803
Tumbling of auto-tire chain 351

V

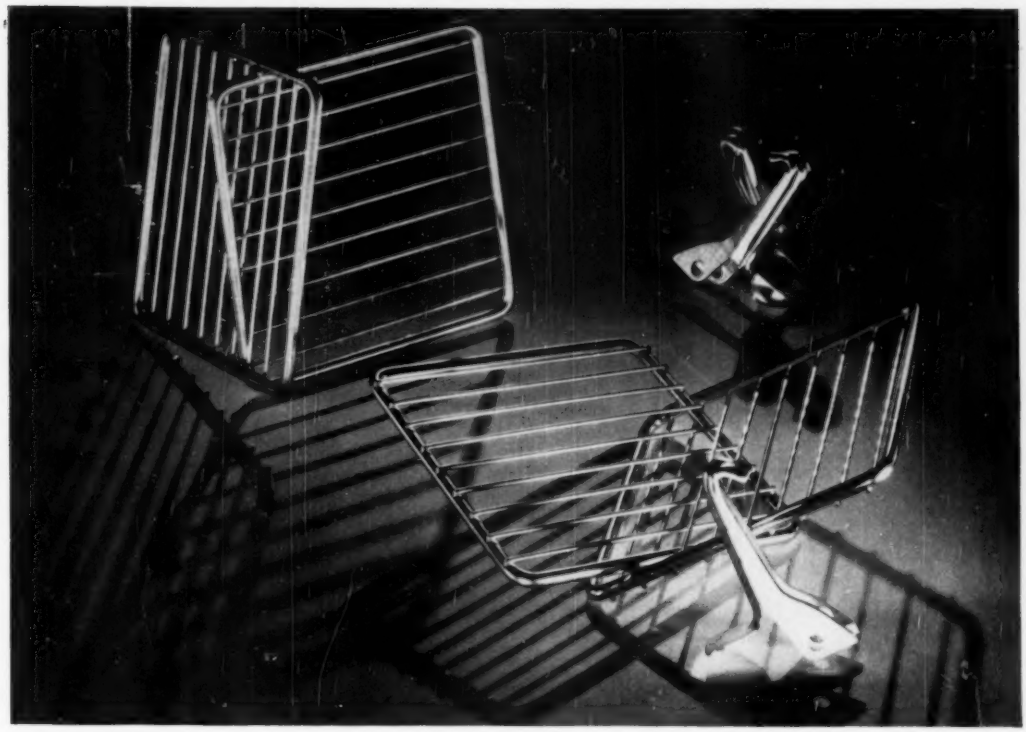
Ventilating equipment, maintenance of 37

W

Waste disposal, cyanide 340, 463, 571, 723, 827
electroplating 154, 919, 1202
Preliminary Planning for Plating Room 1136
Wastes, Electrometric System for Continuous Control of Reduction of Hexavalent Chromium in 1028
Water Pollution from Electroplating Operation 919, 1204
Wire Screen Plating 142

Z

Zinc-base diecastings, troubles in plating on 1217
Zinc-nickel alloy plating 142
Zinc plated steel abrasion resistance of (Q) 829
buffing and lacquering of (Q) 169
Zinc plating of auto-tire chains 351
of coil springs, hydrogen embrittlement in (Q) 371



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Personals

Matawan, N. J. He has held the post of Process Electrochemist for the past three years and continues to be responsible for a number of the company's special processes. His prior experience includes teaching, research, and work in the steel industry.

Dr. Foulke holds degrees from Juniata College and Rutgers University and is widely known in the electroplating field for his numerous articles and talks before the American Electroplaters' Society and others. He was awarded the American Electroplaters' Society Gold Medal in 1945 and is currently chairman of A. E. S. Project Committee No. 2. He is a member of several technical and scientific societies.

Menzel

Thomas J. Menzel has been advanced to the position of Plating Chemist. For the past several years he has been in charge of analytical work and customers' service work. In his new position he will be responsible for all experimental and process plating in Hanson-Van Winkle-Munning's new plating laboratory.

Mr. Menzel holds the degree of B.S. from Hudson College of St. Peters College, Jersey City, N. J. and has also attended New York University. He joined the Hanson-Van Winkle-Munning Company in 1943 as a chemist, later becoming analytical chemist. He is a member of the American Electroplaters' Society.

Walter A. Kesterke has been appointed sales representative for industrial grinding wheels in Wisconsin and southwest Michigan for United States Rubber Company, with headquarters in its Milwaukee, Wis., office.

Mr. Kesterke is a veteran of twenty years experience in malleable iron and steel foundries, having been foundry superintendent of the Edgewater plant of Auto Specialties Manufacturing Company and foundry engineer with the Benton Harbor Malleable Industries, Benton Harbor, Mich.

Sherman M. Goble is now Manager of the new Plating and Electrochemical Department of the Federated Metals Division, American Smelting and Refining Company.

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Personals

Before joining Federated Mr. Goble was with the Seymour Manufacturing Company, Seymour, Conn.; the McGean Chemical Company, Cleveland; and most recently with the Lea Manufacturing Company of Waterbury, Conn. His headquarters will be at 120 Broadway, New York, N. Y.

Joseph B. Dietz is now Manager of the industrial sales section of the Finishes Division of the duPont Company. He succeeds Henry E. Lackey, who retires after a career of nearly forty-three years.

Mr. Dietz has been assistant industrial sales manager since 1945. A native of York, Pa. and a graduate in chemical engineering of Lehigh University, he joined the duPont Company in 1924.

William P. Fisher, Jr., of Unionville, Pa., since 1947 industrial sales manager in the Chicago region, comes to Wilmington as assistant manager of industrial sales.

William E. Kreuer, of Pittsburgh, since 1947 industrial sales manager in the Cleveland region, is transferred to Chicago in the same capacity.

Richard N. Sanger, of Arlington, Mass., since 1946 industrial technical supervisor at Cleveland, is appointed industrial sales manager at Cleveland.

Walter S. Woods II of La Crosse, Wis., an industrial salesman in the Chicago region since 1939, is appointed industrial sales supervisor at Cleveland.

Daniel H. Terry, since September, 1945, a process development chemist in the company's Grasselli, N. J. plant, has been made Manager, Technical Service for Antara Products, General Aniline & Film Corporation.

A research chemist for E. I. duPont de Nemours & Company from 1940 to 1945, Dr. Terry is a Phi Beta Kappa from Randolph-Macon College and received his Ph.D. degree in Organic Chemistry from the University of Virginia in 1940.

John Kosmos has joined the staff of The Chemical Corporation, Springfield, Mass., to head its new laboratory. He is also available for consultation on the metal finishing problems of its customerse

Mr. Kosmos has been actively engagd. in material control, process control, metallurgy and metallography with such companies as Pratt & Whitney and Underwood. His educational background includes studies at the School of Technology of City College, New York, Connecticut School of Engineering, and a degree in Engineering from Trinity College.

W. R. Caple has been appointed coordinator of branch-office activities for the Magnesium Sales Department of The Dow Chemical Company, Midland, Mich. Mr. Caple, who has been in charge of magnesium sales in the Chicago office, received a B.S. degree in Metallurgy from Michigan College of Mining and Technology in 1930. In 1931 he joined The Dow Chemical Company as a metallurgist and in 1935 became a member of the magnesium sales force. In 1949 Mr. Caple received a master's degree in Business Administration from the University of Chicago.

William A. Streaker, a recent graduate of the University of Illinois, has joined The Atlas Mineral Products Company, Mertztown, Pa., as a Chemical Engineer.

Robert F. McKaig of Providence, R. I. has joined the sales and service staff of the Gold Filled Division of American Silver Company, Inc., Flushing, N. Y.

With over sixteen years of experience in the field of gold filled and rolled gold plate he will assist jewelry manufacturers in the New England area. He will make his headquarters in the company's Providence office.

SPARKLER
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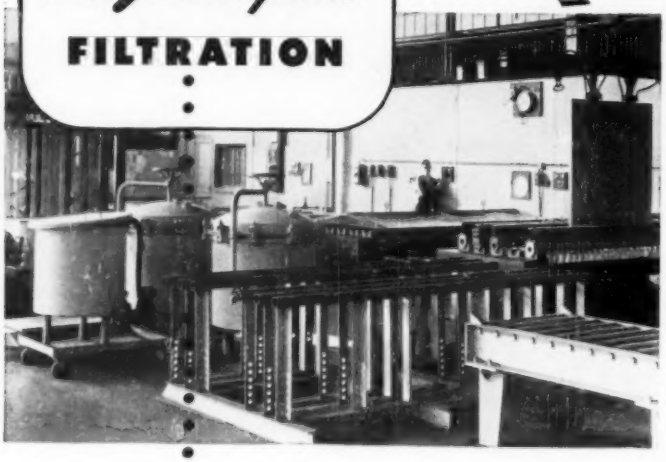
FILTRATION

Plating solutions are circulated through this battery of Sparkler Filters in the Lukens Company plating plant at the rate of 5000 gallons per hour.



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The horizontal plate principle used by Sparkler makes possible the formation of firm, stable filter cakes that will not slip or crack under intermittent or continuous flow. Flow through the filter is always *with* gravity, and filter aid is floated into position, forming a strong cake of even thickness that effectively removes all solids and precipitates from plating solutions. Filters are pressure-tight and leakproof, and are available in rubber-lined construction, stainless steel, or iron. Capacities from 60 to 10,000 G.P.H.

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Platers are no longer bothered by reference to conversion tables when they use the Crōmeter to determine DIRECT chromic acid content in ounces per gallon at the operating temperature of the chrome tank. Many platers find the Crōmeter, which is a special hydrometer, so useful they keep one in the tank at all times. The Crōmeter is used as an adjunct with the Hull Cell for chrome bath control. It is priced so low that no plater can afford to be without one.

PLATERS CONTROL CHROME BATHS WITH ONLY A 5-MINUTE TEST!

Non-productive bath time plus delays in lengthy plant and outside tests are now a thing of the past. With the Hull Cell Plating Test, chemical analyses of chrome baths are completely eliminated, and optimum catalyst content is maintained at all times, even when several catalysts and other metals are present. Also, the more economical, lower strength, higher efficiency baths may be used because of this simplified catalyst control method.

RINS-AID GREATLY IMPROVES RINSING AND REDUCES STAINING OF CHROME PLATE!

Rins-Aid is a new and important ROHCO product used in very small amounts in a static rinse tank. The effect of Rins-Aid is to form a "duck's back," water-repellent surface on chrome plate so that the rinse water flows rapidly from the surface and leaves it practically dry. The advantages to this improved rinsing are many, including greater freedom from staining, much more rapid drying and imparting a buffed, improved appearance to the surface. Rins-Aid is also equally applicable to other plated surfaces such as cadmium, zinc or nickel; and its very small cost is much more than saved in labor and better work.

ROHCO

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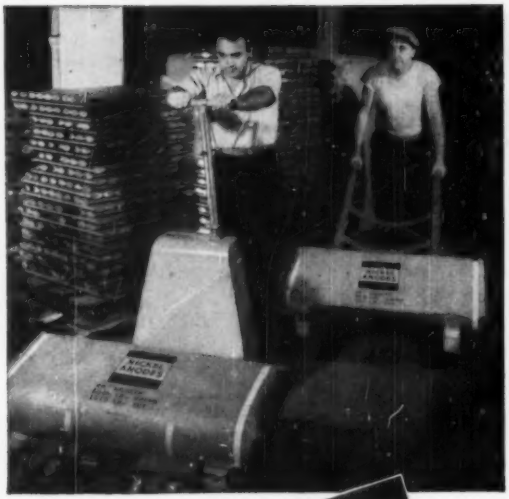

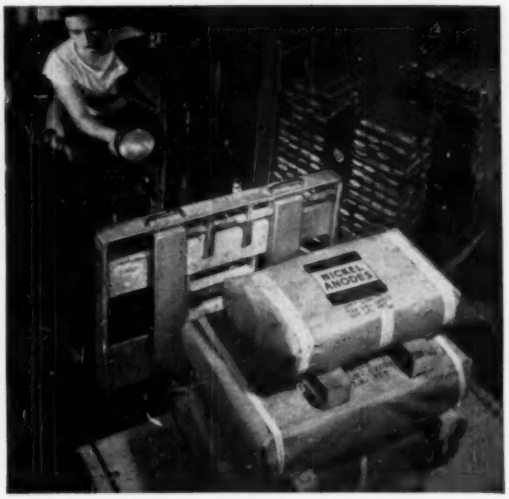

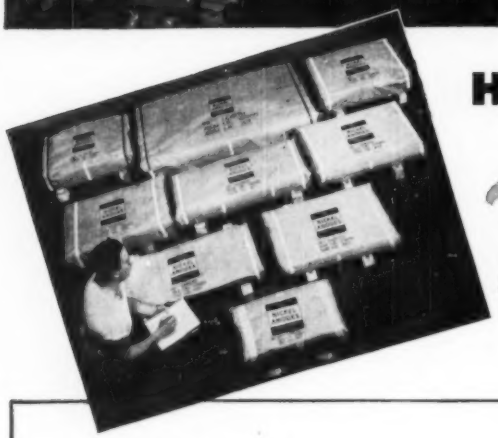

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HARSHAW

Trade Literature

L—309. Plating Supply Price List—Beginning with the August issue the "Plating and Polishing News" issued by Hanson-Van Winkle-Munning Company, Matawan, N. J., will contain a Price Guide on a variety of plating and polishing supplies. For your copy, use Reader Service Card.

L—310. Dust Collectors—A 36-page catalog and price list offered by Aget-Detroit Company, Main at Washington Streets, Ann Arbor, Mich., contains specifications and information on entirely new models and improved models, and illustrations of applications of Dustkops on grinding, buffing, polishing, sanding and other dust-creating operations. A separate section is devoted to vapor collectors which are used to collect mist and vapor from thread grinding, screw machining and centerless grinding, etc. Of special interest is the heat and power savings claimed possible through the use of unit-type rather than conventional centralized dust-control systems. Actual case histories along with drawings of the arrangement of the dust sources are given. For your copy, use Reader Service Card.

L—311. Silicates Serving Industry—Philadelphia Quartz Company, Public Ledger Building, Philadelphia 6, Pa., offers a 15-page pocket-size illustrated booklet on the properties and uses of soluble silicates (solution, lump and powders) in industry. The silicates described are silicates of soda, silicates of potash, sodium metasilicate and sodium sesquisilicate. Chemical characteristics, physical properties, alkalisilica ratio, degrees Baumé, and basic advantages are given for nineteen of the more popular silicates.

Information is presented on major uses, for adhesives, soap builders, detergents, cements, sizes, and coatings, and water clarification. For your copy, use Reader Service Card.

L—312. Acid-Proof Materials—Electrochemical Supply and Engineering Company, Paoli, Pa., offers a 4-page illustrated bulletin which describes its lines of rubber and plastic linings, acid-proof brick and cement, and furnishes a general guide for the design of tanks and chemical equipment, floors and sewers. For your copy, use Reader Service Card.

L—313. Metal Cleaners—Enthone, Inc., Dept. P. 442 Elm Street, New Haven, Conn., has developed an anodic electrocleaner for zinc-base diecastings prior to plating with copper or nickel, an etching-type alkaline cleaner for aluminum which is used to produce a fine-etched finish on aluminum as well as to

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Trade Literature

prepare it for painting and electroplating, a nonetching-type aluminum cleaner to degrease aluminum without attack prior to organic finishing or electroplating, an alkaline anodic electrocleaner for steel, and an alkaline cleaner for nonferrous metals including copper, brass, tin alloys and lead alloys. A series of one-page bulletins are available describing the features of these products. For your copies, use Reader Service Card.

L—314. Cleaning and Drying Equipment—Metalwash Machinery Corporation, 149–155 Shaw Avenue, Irvington 11, N. J., offers a 4-page illustrated Bulletin G12 which describes return-type and straight-through washers and spotless dryers for rack work. Some of them can be built into automatic plating machines. For your copy, use Reader Service Card.

L—315. Centerless Polishing and Surfacing Machines—Production Machine Company, Greenfield, Mass., recently released an 8-page booklet, "The Production Story", which describes the company's background and experience and illustrates its principal products. On the back page are shown two views of the newly completed experimental laboratory. For your copy, use Reader Service Card.

L—316. "Syntheric Detergents—Their History and Applications" is the title of a new descriptive folder just issued by Antara Products, General Aniline & Film Corporation, 444 Madison Avenue, New York 22, N. Y.

Written in nontechnical language, the folder defines both detergents and synthetic detergents and explains the needs for the latter. The three general types of synthetic detergents—anionic, cationic and nonionic—are discussed along with the advantages of each type. An easy-to-use chart gives the name, type, family and uses of 19 surface active agents. For your copy, use Reader Service Card.

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L—317. Primers and Primer Surfacers—A folder describing the line of Zapon primers and primer surfacers has been issued by the Industrial Finishes Department of the Atlas Powder Company, Stamford, Conn., and North Chicago, Ill. Properties of the materials are listed in chart form with recommendations for particular types of surfaces and end uses. The questions, "which primer and which primer surfacer?" are both answered. Points on adhesion, corrosion resistance and appearance are factors in the selection. For your copy, use Reader Service Card.

L—318. Corrosion Resistant Top-Lubricated Plug Valves—The Durco high-silicon iron lubricated plug valve, now known as Type D, is described in a new Bulletin 640 issued by The Duriron Company, Dayton 1, Ohio.

This valve in its basic design has been produced since 1921 and in many severe corrosive conditions has given 20 years or more service without the use of spare parts. More changes and improvements are now available in this valve than have been announced in 18 years. These are (1) new type lubricator, permitting loading with stick or bulk lubricant; (2) composite plug (optional) consisting of Duiron or Durichlor plug and high-strength stainless-steel shank; (3) Teflon diaphragm at the bottom of the stuffing box which provides an anti-friction corrosion-proof seal; (4) standard packing glands in Durimet 20, a highly alloyed corrosion-resisting stainless steel. For your copy, use Reader Service Card.

L—319. Water Conditioning—A 20-page Bulletin No. 610, "Elgin Water Conditioning", issued by Elgin Softener Corporation, Elgin, Ill., tells where it may be used profitably and why. The information on the design and application of water-conditioning equipment covers zeolite water softeners, water-treating chemicals, water-conditionigg systems for boilers and processing, water-softener modernization, zeolites, water filters, taste and odor removers, and aerators. An improved water softener which delivers up to 44 per cent more soft water per regeneration and which eliminates the loss of zeolite mineral is described in detail. For your copy, use Reader Service Card.

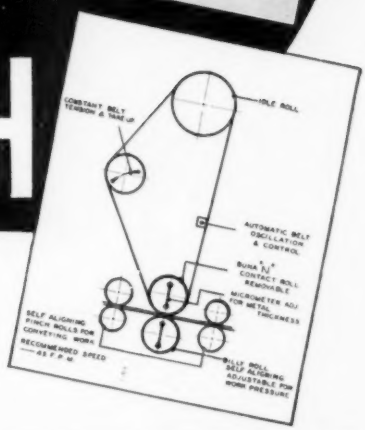
L—320. Magnifying Instruments—Illustrated data sheets describing three new optical inspection instruments have

MICRO-POLISH unit showing accessible controls and neat compact designs.

MICRO-POLISH unit with cabinet removed to show interior construction.

MICRO-POLISH

An outstanding system of sheet-grinding and polishing proved-right in actual operation.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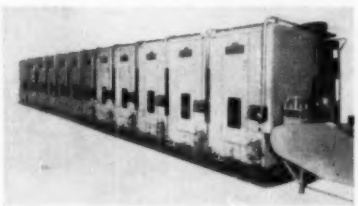

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AUTOMATIC POLISHING, BUFFING, GRINDING EQUIPMENT

Trade Literature

been issued by Buhl Optical Company. The instruments are the S-129 Pocket Microscope (40 to 60 power), the S-152 Handi-scope (20 power), and the S-42 Magniprox desk magnifier.

Specifications, prices and operating information are included in the description of each instrument. Copies may be obtained by writing the manufacturer, care of Desk 7-131, 1009 Beech Avenue, Pittsburgh 12, Pa., or by using the Reader Service Card.

L—321. Permanent Gloss Standards—Permanent gloss standards, covering the entire gloss range of non-metallic commercial materials, which may be used to calibrate any 60-degree specular glossmeter in the range from matte to high gloss, are made of ceramic materials for permanence, and the surfaces have been specially chosen for similarity to commercial materials whose gloss is important. Sets of the 60-degree specular gloss standards may be ordered from the National Bureau of Standards, Washington 25, D. C., at $70.00 a set.

L—322. Infra-Red Heat Lamps—A 500-watt sealed-beam industrial heat lamp manufactured by Amplex Corporation, 111 Water Street, Brooklyn 1, N. Y., is described in Catalogue No. A 230. It incorporates a new type of tungsten filament which is built with a protective supporting structure never before applied to heat lamps and has been pretested for twist and sag. The inside of the bulb is lined with pure silver which acts as a reflector that never needs cleaning.

Other new Amplex heat lamps include sizes from 125 watts and up, each equipped with an all-mechanical base-locking construction that permanently locks the glass bulb to its base and is said to keep it locked no matter how high or sustained the temperature to which it is subjected. For your copy, use Reader Service Card.

L—323. Small Selenium Rectifier. Rapid Electric Company, 2847 Middletown Road, Bronx 61, N. Y., has put out a specification describing its 5-ampere, 0-7-volt output, 110-120-volt 1-phase a-c input selenium rectifier No. 507. Features and suggested applications are listed. For your copy, use Reader Service Card.

L—324. Corrosion Resisting Self Priming Pump—The Model 40 Series R Self-Priming Durcopump, now in regular production after two years of experiment and plant and field testing, is described in an illustrated 4-page Bulletin 816, issued by The Duriron Company, Dayton 1, Ohio.

The air-handling capacity of the new pump is said to be greater than that of any self-priming pump on which comparative tests were made. It is available in two sizes, one with capacity ranging from 20 gpm against 81 ft tdh to 160 gpm against 33 ft tdh and the other with capacity ranging from 40 gpm against 125 ft tdh to 240 gpm against 75 ft tdh, when operating at 1750 rpm. Larger pumps are expected to be available later. Features include availability in 12 corrosion-resisting alloys, Teflon Seal cages in stuffing boxes for lubricant or liquid seal which cannot score the shaft sleeve, micro-adjustment of impeller in casing, renewable shaft sleeves, corrosion-protected bearing construction in power end, and elimination of impeller nuts. For your copy, use Reader Service Card.

L—325. Heavy Duty Soak Cleaner—The Metal Industries Department of The Diversey Corporation, Chicago, has issued a novel 4-page file-size folder on Diversey No. 909, heavy-duty soak-tank metal cleaner.

The folder features economy of use—"Savings up to 50 per cent, on the average, of present cleaning costs"—and enumerates features of the cleaner, applications, and directions for its use. For your copy, use Reader Service Card.

L—326. Electric Thickness Gage for Aluminum Oxide Coatings—Recently a new, rapid, nondestructive electrical method was developed for measuring the thickness of oxide coatings. It employs the Filmeter or electrical gage, a portable, battery-operated electronic beat-frequency oscillator manufactured by American Instrument Company, Inc., Silver Spring, Maryland.

An article entitled "Measurement of Thickness of Oxide Coatings on Aluminum

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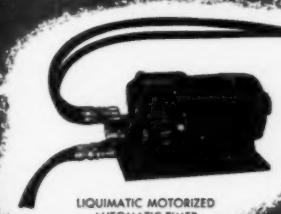

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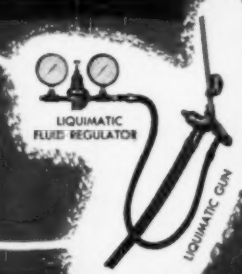

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Alloys" by Ralph B. Mason and William C. Cochran of the Aluminum Company of America explains the operation of the Filmeter and its advantages for this particular type of measurement. Reprints of this article, also Bulletin N-2150 which describes the Filmeter and its application to the measurement of the thickness of other nonconducting coatings on nonmagnetic base metals, are obtainable. For your copies, use Reader Service Card.

L—327. Waste Disposal—A book entitled "Treatment and Disposal of Industrial Waste Waters", published by the British Department of Scientific and Industrial Research, is said to be the first publication on the subject to appear in Great Britain in 35 years. It discusses methods of treatment tried in various industries and summarizes the results. Copies are obtainable from the British Information Services, New York 20, N. Y. Price each, $3.65.

L—328. "The Story of Magnesium" is a 262-page 5¼ x 7¾-inch book by W. H. Gross recently published by American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio, at $2.00 per copy. Chapter headings include History; Production; Alloying, Melting and Refining; Casting; Fabrication; Machining; Joining; Surface Finishing; Physical Metallurgy; and Uses. It has 100 illustrations. Order your copy from the publisher.

L—329. Belt Surfacing Machine—Proudction Machine Company, Greenfield, Mass., offers a 4-page Bulletin No. 10 which describes a Wet or Dry Belt Surfacer with working surface 20 x 30 inches on which large parts may be oscillated. The illustration shows a 9 x 15½ inch machine of similar construction. The new ribbed surface platen permits chip clearance thereby preventing loading of the belt. For your copy, use Reader Service Card.

L—330. Barrel Tumbling—A Barrel Tumbling Manual, released by the Frederich Gumm Chemical Company, 538 Forest Street, Kearny, N. J., is said to be the first comprehensive manual on barrel finishing ever offered to the trade. It includes basic information on barrel finishing with numerous practical instructions and suggestions; specific data on deburring with metallic and nonmetallic media and of self-rolling parts. There is also considerable information on burnishing, the preparation of work for burnishing, care of the burnishing medium, etc. In addition it contains information on calculation of barrel sizes, void-space volume, etc. This book is available without charge upon application to the company. Please mention PLATING.

L—331. Rust Preventives—In connection with the revision of its line-up of rust preventives for industrial purposes, E. F. Houghton & Company, 303 W. Lehigh Avenue, Philadelphia 33, Pa., manufacturers of such protective products since introducing Cosmoline in 1869, have published a new booklet on rust preventives.

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L—332. Corrosion Resisting Plug Valves—The Duriron Company, Dayton 1, Ohio, offers three 2-page illustrated Bulletins 636, 637 and 638 which describe and give specifications for several kinds of plug valves available in several corrosion-resistant alloys. For your copies, use Reader Service Card.

L—333. Engineered Equipment for Heat Treating, Pickling—Brown-Hutchinson Iron Works, 1831 Clay Street, Detroit 11, Mich., offers an 8-page brochure giving performance and cost-saving case histories of specially designed pickling racks and baskets and other fixtures fabricated of corrosion-resistant alloys. For your copy, use Reader Service Card.

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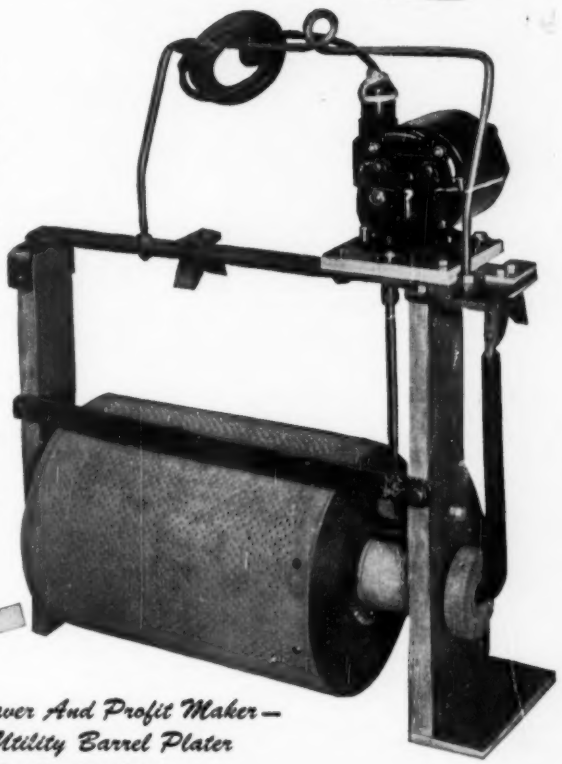

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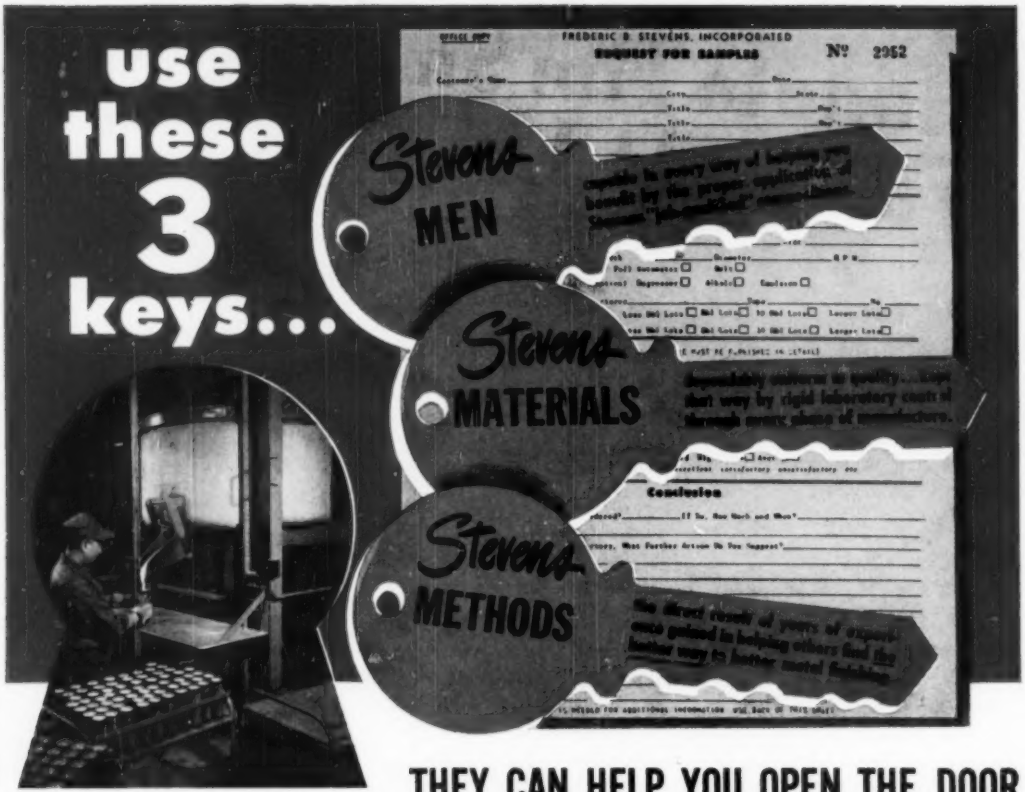

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Contents

Electrodeposition of Alloys of Phosphorus and Nickel or Cobalt 36
A. Brenner, D. E. Couch, and E. K. Williams

Large Scale Finishing of Diecastings 44

Photoelectric Colorimetry 53
Raffaele F. Muraca

Preparation of High Carbon Steel: A Tentative Recommended Procedure 59
A. S. T. M. Committee B-8

Determination of Impurities in Electroplating Solutions: XVI. Traces of Chloride in Copper Plating Baths 62
E. J. Serfass and M. H. Perry

A. E. S. Convention News 85

1949 Index Opposite page 18

Monthly Features

Industry News 4
Personals 20
Trade Literature 25
Editorial 35
Leaders in Industry 41
Question Box 71
Book Review 72
Article Abstracts 73
Patent Abstracts 77
Equipment and Supplies 80
A. E. S. News 85
Branch News 86
Membership Report 95
A. E. S. Directory 97
Advertising Index 99
Letter from the Editor 100
Future Meetings 100

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Editorial

The halfway mark

AS WE ENTER the second half of the twentieth century many editorials will be written about the changes that have been wrought during its first half and that may be expected during its second. One could easily write such an editorial about the plating industry. It seems more appropriate, however, to deal with a more basic aspect of the present situation.

The nineteenth century has been characterized by its faith in progress. Our experiences during this century with its two World Wars and worldwide revolutionary movements have made most of us lose faith in the inevitability of progress. We are learning that progress does not depend on inanimate forces and hence does not come about automatically. Instead it depends on people; and people do with equal facility act for good and evil, for progress and regression.

In a more restricted sense and aside from the great moral problems that confront the world, progress in any field depends on the availability of individuals with ability to see facts as they really are, to think clearly, and to act energetically on the evidence. This requires education of a high order.

The question arises, "What is the plating industry doing to attract and to educate the younger generation and to furnish it with greater possibilities within the plating field"?

One should acknowledge at once that more facilities are now available for education at the shop level than ever before and that the quality of plating books and journals has risen. That is all to the good, but only as far as utilization of existing knowledge is concerned. When we look at higher levels of education, the position of the industry is actually worse than ten or twenty years ago, with fewer schools providing courses designed especially for electroplaters. The reasons are many: among them divorcement of capable teachers from active teaching and the limited value of traditional electrochemistry in providing fresh avenues of approach to practical problems. Thus present-day plating research with few exceptions is still conducted largely on a cut-and-try basis.

It is discouraging to compare electroplating research with research in, for example, plastics or petroleum chemistry in which theory and practice are much more closely allied. The fact is that a sound theoretical basis for electroplating is almost completely lacking. As a result progress in plating is slow and halting when contrasted to that in many other fields.

A new approach to the whole problem of educating plating researchers seems indicated. The new department certainly should be on the postgraduate level and provide courses in electrochemistry, metallurgy, physics, and mathematics on the highest plane, all slanted to the specific needs of electroplating. It would require a highly competent teaching staff in close contact with the industry and accept only highly qualified students. Besides adequate staff salaries it should have for distribution a substantial number of fellowships for fundamental research. One can be certain that students so trained would have no difficulty in finding remunerative employment in their chosen field.

One or more of our higher institutions of learning in considering in what direction it can best expand to serve industry should give serious thought to the needs of the plating industry. Undoubtedly many have the resources, facilities and staff to set up an efficient department. The American Electroplaters' Society could well be instrumental in encouraging this development.

Thus while we hope and pray for a better continuation than beginning of this century, we should not neglect to act on the fundamental plane of education. What better time to begin than now, at the halfway mark?

Gustaf Soderberg

Electrodeposition of alloys of phosphorus and nickel or cobalt

ABNER BRENNER, DWIGHT E. COUCH, AND EUGENIA KELLOGG WILLIAMS

National Bureau of Standards, Washington, D. C.

I. Introduction

Deposits of cobalt and nickel have been produced by chemical reduction[1] of solutions of their metal salts with hypophosphites at elevated temperatures. These deposits contained several per cent of phosphorus and were harder than ordinary electrodeposits of nickel or cobalt. They increased in hardness when heat treated at 750° F (400° C) and were not appreciably softened by annealing at 1110° F (600° C). The nickel-phosphorus deposit is also of interest because it is semi-bright when deposited from an alkaline solution. The properties of the deposits obtained by chemical reduction in the "electroless" process were of sufficient interest to lead to an attempt to find more satisfactory conditions of deposition. Since the electroless process is uneconomical, produces deposits at a slow rate, and does not permit control of the composition of the deposits, attention was directed toward a study of the electrodeposition of metals with phosphorus.

Alloys of nickel or cobalt containing as much as 15 per cent of phosphorus were obtained by electrodeposition from acid solutions containing phosphites. These alloys are of theoretical interest because many of them contain over 50 per cent of the metal phosphide and yet in all of their properties are decidedly metallic. The electrodeposition process is also of theoretical interest because phosphorus is nonmetallic and does not conduct current and in this process is deposited from an anion.

The effect of phosphites and hypophosphites in other plating baths was examined qualitatively but as no obviously interesting results were obtained no analyses were made of the deposits. The baths investigated included acid copper, acid zinc, and hot ferrous chloride. The addition of phosphorus compounds produced a black or rough deposit in the last bath and had little effect on the others except to make the deposits rough. Similarly, no important result was obtained with a cyanide silver bath, a cyanide zinc bath, or an alkaline tin bath. The deposit from an alkaline cobalt-tungsten bath to which phosphite had been added did not contain any phosphorus.

In our initial efforts to electrodeposit the phosphorus alloys the conditions were similar to those employed in the electroless plating process, but no alloys were obtained. Later it was found that the conditions for the electrodeposition of the phosphorus alloys are quite different from those required for the electroless process. This is shown by the following contrasts: (1) electroless plating is readily conducted with ammoniacal solutions, but phosphorus alloys of cobalt and nickel cannot be electrodeposited from such solutions; (2) cobalt-phosphorus alloys cannot be obtained from an acid solution by the electroless process but are readily obtained by electrodeposition; (3) phophites are the most satisfactory source of phosphorus for the electrodeposition process, but they produce no reduction to metal in the electroless plating process.

II. Composition of Plating Baths and Conditions of Plating

The best deposits were obtained from ordinary nickel or cobalt baths to which phosphoric and phosphorous acids had been added. The favorable *p*H of the baths was between 0.5 and 2.0, depending upon their compositions. Tables I and II give the composition and operating conditions of several satisfactory baths. Deposits may be obtained also from acid solutions containing only the metal phosphite (solutions Ni-P and Co-P, Tables I and II).

TABLE I. COMPOSITION OF TYPICAL BATHS FOR DEPOSITION OF PHOSPHORUS ALLOYS

Bath No.	Bath Type*	$NiSO_4 \cdot 6H_2O$			$NiCl_2 \cdot 6H_2O$			Metal as Phosphate or Phosphite†	H_3PO_4			H_3PO_3		
		oz/gal	g/l	mole/l	oz/gal	g/l	mole/l	mole/l	oz/gal	g/l	mole/l	oz/gal	g/l	mole/l
1	Ni-L	23.3	175	0.67	6.7	50	0.21	0.13	6.7	50	0.5	0.17	1.3	0.015
2	Ni-H	20.0	150	0.57	6.0	45	0.19	0.24	6.7	50	0.5	5.3	40	0.5
3	Ni-P	....	....	....	....	....	....	1.0	....	....	....	21.4	160	2.0
					$CoCl_2 \cdot 6H_2O$									
4	Co-L	....	....	....	28.0	210	0.88	0.12	6.7	50	0.5	0.27	2.0	0.02
5	Co-H	....	....	....	24.0	180	0.76	0.24	6.7	50	0.5	5.3	40	0.5
6	Co-P	....	....	....	....	....	....	1.0	....	....	....	21.4	160	2.0
7	Co-F	....	....	....	32.0	240	1.0	....	‡	‡	‡	0.27	2.	0.02

*The letters "L" and "H" refer to phosphate-phosphite baths which produce deposits of low- and high-phosphorous content, respectively; "P" refers to baths containing no anion other than phosphite; "F" refers to a bath containing formic acid. Hydroxyacetic acid in concentrations of 50–60 g/l may be substituted for the formic acid in this bath.

†This is the metal combined with the H_3PO_4 and H_3PO_3. A solution of those acids was partially neutralized with metal carbonate. About 15 lb of metal carbonate (containing about 7.5 lb of metal) is required to neutralize 50 lb of H_3PO_4 (equivalent to 4.2 gal 85 per cent phosphoric acid) or 40 lb of H_3PO_3 (equivalent to 13.8 gal 30 per cent phosphorous acid to *p*H 0.5–1.0. All of the baths above were prepared so that the total metal concentration was about 1 molar (60 g/l; 8 oz/gal).

‡This bath contained no H_3PO_4 but 6 oz/gal (45 g/l; 1 mole/l) formic acid, HCOOH.

TABLE II. OPERATING CONDITIONS AND DEPOSIT CHARACTERISTICS OF TYPICAL BATHS FOR DEPOSITION OF PHOSPHOROUS ALLOYS

Bath No.	Bath Type	Current Density		*p*H	Temperature		Cathode Efficiency per cent	P in Deposit per cent	Type of Deposit
		asf	amp/dm²		°F	°C			
1	Ni-L	46–370	5–40	0.5–1.0	167–203	75–95	65	2–3	Dull, matte, strong
2	Ni-H	46–370	5–40	0.5–1.0	167–203	75–95	50	12–15	Bright, strong, brittle
3	Ni-P	46–370	5–40	0.5–1.0	167–203	75–95	..	..	Bright, strong, brittle
4	Co-L	46–370	5–40	0.5–1.0	167–203	75–95	90	1–2	Dull, matte, strong
5	Co-H	46–370	5–40	0.5–1.0	167–203	75–95	55	9–11	Bright, strong, brittle
6	Co-P	46–370	5–40	0.5–1.0	167–203	75–95	45	11–12	Bright, strong, brittle
7	Co-F	46–280	5–30	1.5–2.0	167–203	75–95	95	0.8–1.2	Dull, matte, strong, some ductility

The plating solutions were prepared by first making up an ordinary plating solution, about 1 molar in metal. A Watts bath may be used as the basis for the nickel-phosphorus bath and a cobalt chloride solution for the cobalt-phosphorus bath. The phosphoric and phosphorous acids were introduced into the bath in the form of a stock solution prepared by partially neutralizing the acids to a *p*H of about 1.0 with a basic carbonate of the desired metal. This stock solution contained the metals as the acid salts along with free acid. When a low concentration of phosphite was required, as in bath Co-F, the acid could be added directly to the bath. With the cobalt bath, Co-F, pitting is likely to occur and the addition of a wetting agent may be necessary for the production of thick deposits. In electroforming deposits about 0.3 inch

(8 mm) thick from the latter bath it was also found expedient to add saccharin, 0.7 oz/gal (5 g/l), to reduce the stress in the deposit.

In this study, a number of different bath compositions were tried and discarded. The following discussion summarizes the materials tried and the reasons for acceptance or rejection.

In the earlier stages of this study, baths containing hypophosphites were tried and were found to yield deposits that contained phosphorus. Some of these deposits were quite bright. However, they were unsound and frequently were so highly stressed that they developed visible networks of cracks. Another reason for abandoning work with the hypophosphites was that they were not stable in hot solutions. Phosphorous acid, on the other hand, is apparently stable in hot solutions. It is available in commerce, usually as a 30 per cent solution but can be obtained in solutions of higher concentration and also as a crystalline solid. The price is about $1.00 per pound of anhydrous acid.

One of the most important considerations in the successful electrodeposition of the phosphorus alloys is the *p*H of the plating solutions. If the *p*H is more than several tenths above an optimum value, the deposits are likely to be discolored, stressed, or unsound; if the *p*H is too low, the cathode current efficiency is very low.

Because of the necessity of controlling the *p*H within narrow limits, it early became apparent that buffers would simplify the control of the bath. A number of acids were tried as buffers, among them organic acids such as acetic, formic, hydroxyacetic, malic, citric, gluconic, and tartaric; and inorganic acids such as boric and phosphoric acids. These acids had specific effects on the quality of the deposits. For example, formic, acetic, and hydroxyacetic acids yielded good deposits from a cobalt-phosphorus plating bath, whereas citric, malic, and gluconic acids yielded highly stressed deposits. From a nickel bath, containing 8 oz/gal (60 g/l) of hydroxyacetic or citric acid, the deposits were fairly satisfactory when the *p*H of the bath was kept below 1. However, these deposits were found to warp and blister when they were heat treated at 1110° F (600° C). This did not occur if phosphoric acid was used as the buffering agent in the bath, and in general this acid yielded better results than the organic buffers. In the presence of some of the organic acids in the nickel bath—tartaric, glycine, and aspartic acids—very poor deposits were obtained.

In the earlier work it was found that metal salts, such as chloride, sulfate, and fluoborate, did not yield equally satisfactory deposits. Some of these differences might have been eliminated if a satisfactory buffer such as phosphoric acid had been used initially. As an example of the differences which were observed, a solution for deposition of cobalt-phosphorus alloy which was made up with sulfate and no buffering agent had a cathode current efficiency of only 10–20 per cent as compared with about 80 per cent for a similar bath made up with cobalt chloride. In developing the nickel-phosphorus bath, the sulfate was found to be more satisfactory than the chloride. Fluoborates offered no advantages over the sulfate or chloride.

Nickel or cobalt anodes were used in the baths, and they corroded uniformly. Since the current efficiency of solution of the anode was probably 100 per cent, the metal concentration in the baths tended to increase.

III. Examination of Deposits

Alloy coatings from 0.002 to 0.02 inch (50 to 500 μ) thick were deposited upon copper tubes about 3/16 inch (5 mm) in diameter. The test for the soundness of the deposit was to dissolve the copper tube with a polysulfide solution and note whether the alloy tube held together. If it did, it was further qualitatively tested for strength by crushing it with a pair of pliers. Observations were also made of the ductility of the deposit by noting whether the tube of alloy or fragments of it would take a permanent set upon bending. Specimens of the sound deposits were heated to various temperatures and similar tests for strength and ductility were made again. On the basis of these qualitative tests, a decision was made as to whether the solution under investigation should be studied further or discarded.

Besides the qualitative examination of the physical properties of the deposits, their hardnesses were measured with a microhardness tester and their electrical resistivities were determined. These measurements were made on deposits as removed from the bath and on those which had been subjected to various heat treatments.

The procedure was as follows: A 4–6 inch (100–150 mm) length of copper tubing was plated with the alloy, then cut into several small sections, and the copper removed by stripping. The hardness of the alloy as deposited was measured. Other sections from the same tube were heated to 750, 1110 and 1470° F (400, 600, and 800° C), then tested after cooling. The resisitivity was measured on the alloy as deposited. The measurements were repeated on the same sample after heating to 750, 1110 and 1470° F (400, 600, and 800° C). A few measurements of reflectivity and of tensile strength were also made. The phosphorus content of the alloys was determined gravimetrically by the phosphomolybdate method. The heat treatments of the alloys did not reduce their content of phosphorus. The corrosion resistance of the deposits to acids and to the salt spray was also determined.

IV. Effect of Bath Composition and Conditions of Plating Upon the Deposits

Because the most satisfactory baths were evolved gradually in the course of the investigation, much of the data on the effect of operating conditions on the character of the deposits was determined for baths which do not represent the best composition. However, since the composition and properties of the deposits from the different baths were similar, it was

not necessary to repeat this work with those baths finally selected as the best.

1. *Concentration of Phosphite*

Fig. 1 shows how the phosphorus content of the cobalt and nickel deposits varied with the concentration of phosphorous acid. For a given concentration of the acid, more phosphorus was codeposited with the nickel than with the cobalt, particularly in the baths which contained low concentrations of phosphite. The dotted line, 4, in the graph represents alloys having the same ratio of phosphorus to nickel or cobalt as exists in the solution. The nickel-phosphorus alloy (curve 1) from the baths containing less phosphorous acid than 1.3 oz/gal (10 g/l) had a higher ratio of phosphorus to metal than existed in the bath. Accordingly, phosphorus seems to be the more readily deposited element under these conditions.

The maximum amount of phosphorus obtained in the nickel deposit was about 15 per cent and in the cobalt deposit about 10 per cent. No attempts were made to determine the maximum amount of phosphorus that could be introduced into the deposits. It is likely that higher ratios of phosphite to metal in the baths would give deposits higher in phosphorus.

The cathode current efficiency of deposition from the nickel bath decreased markedly as the content of phosphite in the bath was increased. This is shown by the curves in Fig. 2 and by the position of the curves in Fig. 3.

2. *pH of Bath*

The importance of *p*H and the general considerations which led to the operation of the cobalt and nickel baths at low *p*H have already been discussed in the introductory section. If the *p*H of a cobalt bath were too high and no buffers were present, basic material was deposited upon the cathode. In some instances smooth deposits of a pink cobalt compound formed upon the cathode to a thickness of several tenths of a millimeter, i. e., much faster than a metal coating of equal thickness could be deposited. Frequently the basic material was firm enough to be removed from the copper cathode in the form of a tube.

The necessity of operating the phosphorus-alloy baths at a low *p*H of 0.5–2.0 was not anticipated, as the electroless plating baths operate at a relatively high *p*H. Furthermore, experiments on the addition of alkali to phosphorus-alloy baths indicated that precipitation did not occur until the *p*H reached 4–5 in the low-phosphorus bath and 3–3.5 in the high-phosphorus bath. Thus, the alloy baths are operated at 2.5 *p*H units below the precipitation point of the bath. A low *p*H is apparently necessary for the successful electroreduction of the phosphite, quite apart from its function in preventing precipitation of basic compounds at the cathode.

The *p*H of the bath within the operable range does not have any appreciable effect upon the content of phosphorus in the deposits. The main effects of *p*H

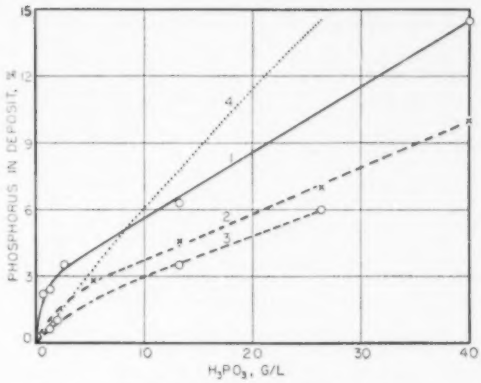


Fig. 1. Effect of concentration of phosphorous acid in bath on percentage of phosphorus in deposit. Bath operated at 75° C and 10 amp/dm². Deposits from (1) phosphorus-nickel bath, (2) phosphorus-cobalt bath, (3) cobalt-fluoride-type bath. Line (4) represents alloys having the same value of P/(metal + P) as the bath

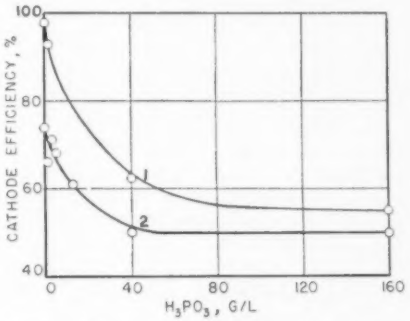


Fig. 2. Effect of concentration of phosphorous acid on cathode current efficiency at 75° C in (1) phosphorus-cobalt, (2) phosphorus-nickel baths

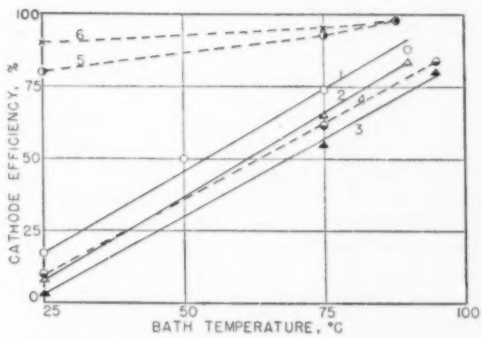


Fig. 3. Effect of temperature on the cathode current efficiency of phosphorus-nickel and phosphorus-cobalt baths. (1) Bath Ni-L, but containing no phosphorous acid, (2) Bath Ni-L, (3) Bath Ni-H, (4) Bath Co-H, (5) Bath Co-L, (6) Bath Co-F

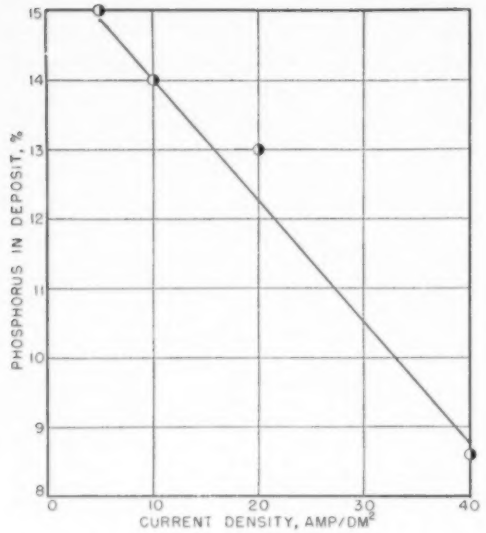


Fig. 4. Effect of current density upon percentage of posphhorus in alloys deposited from Ni-H bath

are on the cathode efficiency and on the soundness of the deposits. The *p*H of the high-phosphite baths, Ni-H and Co-H, is more critical than that of the low-phosphite baths and must be kept between 0.5 and 1.0. If the *p*H is lower, the cathode efficiency decreases markedly. If the *p*H is much above 1, it is difficult to obtain uniformly bright deposits.

3. *Temperature*

Temperature is one of the most important variables in plating the phosphorus alloys. The deposits obtained at room temperature were stressed and unsound. The low mechanical strength of the deposits obtained at room temperature was apparent only after the basis metal had been dissolved, otherwise the deposits appeared quite satisfactory. Most of the plating in this investigation was done at 167° F (75° C).

The operation of the cobalt bath was not as sensitive to temperature as that of the nickel bath. If the alloy baths were operated at room temperature instead of 167° F (75° C), the cathode current efficiency of the low-phosphorus cobalt baths dropped only slightly, but the cathode efficiency of the corresponding nickel bath became very low. The high-phosphorus cobalt (Co-H) baths had much lower efficiencies at room temperature than at 167° F (75° C). However, they produced deposits at lower temperature and at lower *p*H than the corresponding nickel bath. If the nickel bath contained much phosphite, the efficiency at room temperature was only a few per cent, and in some cases all that was obtained upon the cathode at this temperature was a black coloration. Fig. 3 shows how the cathode current efficiency of alloy deposition changes with concentration of phosphite and temperature. The cathode current efficiencies were based upon the composition of the deposit and the phosphorus was assumed to have been reduced from a valence of three.

4. *Agitation*

Agitation of the bath did not seem to have any value in improving the appearance or physical properties of the deposits. It was resorted to only to prevent stratification of the solution.

5. *Current Density*

The deposits of nickel- or cobalt-phosphorus did not vary materially in appearance or physical properties when the current density was varied over a wide range. At 167° F (75° C), deposits could be produced at current densities ranging from 46 to 280 asf (5 to 30 amp/dm²), but when the current density was below 46 asf (5 amp/dm²), sometimes the deposit did not completely coat the basis metal. The content of phosphorus in the deposits plated from the low-phosphorus baths did not vary appreciably with current density. The deposits from the high-phosphorus nickel bath, Ni-H, showed a decrease in content of phosphorus as the current density was raised. This is illustrated in Fig. 4.

The cathode current efficiency of deposition of neither cobalt nor nickel alloys varied appreciably with variations in current density. Fig. 5 shows data for the deposition of nickel-phosphorus alloys.

V. Properties of the Deposits

1. *Appearance*

The deposits varied in appearance, depending on their content of phosphorus. The deposits containing 2 per cent or less of phosphorus were smooth and fine-grained but with a matte appearance very much like ordinary nickel or cobalt electrodeposits. Smooth deposits 0.3 inch (8 mm) thick were electroformed from the Co-F bath without difficulty. Deposits with a phosphorus content of about 5 per cent were semi-bright and with a phosphorus content above 10 per cent fully bright. These were true bright deposits because when formed on a dull surface they increased in brightness (although not in smoothness) with increase in thickness. The bright deposits had a slightly dark or yellowish cast as might be expected from the fact that they contained a considerable amount of phosphide. Their reflectivity was about 45–50 per cent as compared with 60 per cent for nickel. The reflectivity of buffed deposits which contained only 2 per cent of phosphorus was only slightly lower than the reflectivity of the pure metals.

2. *Hardness*

Interest in the hardness of the deposits gave the initial incentive for this study of the phosphorus alloys. The phosphorus-cobalt and -nickel alloys were harder than the pure metals. These alloys increased in hardness on heat treatment to an even

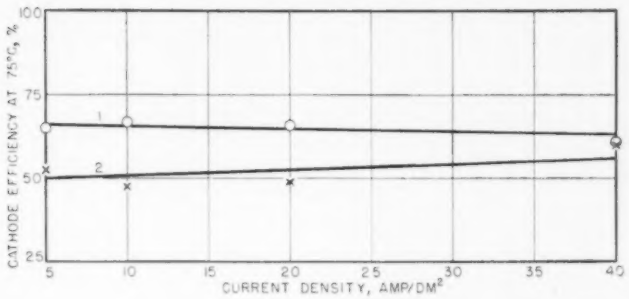


Fig. 5. Effect of current density on cathode current efficiency of phosphorus-nickel baths operated at 75° C. (1) Bath Ni-L, (2) Bath Ni-H

larger extent than did the tungsten alloys of these metals [1A]. The hardness of the phosphorus alloys, as deposited, ranged from about 350 to 700 Vickers. After heat treatment, the hardness of most of the deposits increased, with the maximum effect occurring at about 750° F (400° C).

Fig. 6 shows typical data for nickel- and cobalt-phosphorus deposits. The low-phosphorus nickel deposits were harder than the corresponding cobalt deposits. Because the data for the nickel deposits cover a wider range of composition than for the cobalt deposits, more specific conclusions can be drawn regarding them. It is interesting to note that the hardnesses of the nickel deposits with from 2.5–13 per cent phosphorus were about the same. The main effect of the higher contents of phosphorus was to cause the deposits to remain harder after being heat treated at 1470° F (800° C).

The graph for the low-phosphorus cobalt deposits (Curve 5, Fig. 6) represents the average of about 15 deposits ranging in composition from 0.5 to 1.5 per cent phosphorus. This curve represents within about 50 units the hardnesses of all of these samples. There were some minor variations in hardness depending on the bath and conditions of plating, but the data were not consistent enough to determine whether these differences were outside the limits of reproducibility. The main difference between the deposits containing 0.5 and 1.5 per cent of phosphorus was that those with the higher phosphorus contents were harder after the heat treatment at 1470° F (800° C) than the alloy as deposited. The high-phosphorus nickel and cobalt deposits became as hard as bright chromium after being heat treated at 750° F (400° C). Heat treatment at higher temperatures (1470° F; 800° C) does not soften the alloys as much as it does chromium. However, measurements of the hot-hardness of these alloys indicate that it was disappointingly low. The results are given in Table III with cobalt as a basis of comparison.

3. *Strength and Ductility*

The ductility of the deposits was examined qualitatively by determining whether they would bend or take a permanent deformation when a specimen in the form of a tube was crushed. The cobalt deposits con-

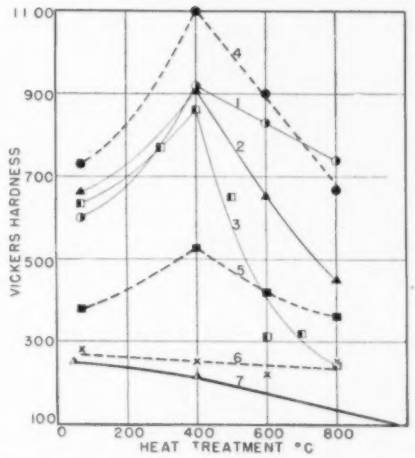


Fig. 6. Effect of one-hour heat treatment on hardness of phosphorus-nickel and phosphorus-cobalt alloys. (1) Bath Ni-H, 13–14 per cent phosphorus in deposit; (2) Bath Ni-H, 6–7 per cent phosphorus in deposit; (3) Bath Ni-L, 2–3 per cent phosphorus in deposit; (4) Bath Co-H, 10–11 per cent phosphorus in deposit; (5) Bath Co-F, 0.5–1.5 per cent phosphorus in deposit; (6) Straight $CoCl_2$ bath; (7) Straight $NiCl_2$ bath

taining up to 1 per cent of phosphorus and nickel deposits containing up to 2 per cent of phosphorus were strong and slightly ductile. The low-phosphorus-cobalt deposits had a tensile strength of about 130,000 psi (9,100 kg/cm²) (as compared with about 75,000 psi (5,300 kg/cm²) for electrodeposited cobalt) and an elongation of about 7 per cent. As the phosphorus content of the deposits increased, the deposits became brittle and somewhat weaker. After being heat treated at 750° F (400° C), which is the optimum hardening temperature, the cobalt- and nickel-phosphorus alloys became more brittle. When they had been heat treated at 1470° F (800° C), the deposits with the lower phosphorus contents became more ductile than they were originally while those with the higher phosphorus contents remained brittle. The high phosphorus nickel alloys became quite weak after heating

TABLE III. HOT-HARDNESS OF PHOSPHORUS-ALLOY DEPOSITS

Deposit			Vickers Hardness Number†				
Metal	Bath	P per cent	77° F (25° C)	1110° F (600° C)	1470° F (800° C)	1110° F (600° C)	77° F (25° C)
Cobalt	*	0	320	95	49	..	260
Cobalt	Co-L	1.0	350	100	40	90	340
Cobalt	Co-H	10.	700	50	..	123	695
Nickel	Ni-L	2.3	345	70	2	30	...

*Electrolytic cobalt deposited from a chloride bath.

†These hardnesses were taken in the order shown, i. e., the second hardness at 1110° F was taken after the sample had been heated to 1470° F, then cooled to 1110° F.

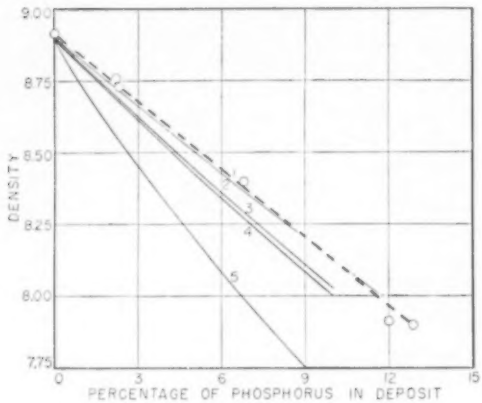


Fig. 7. Effect of percentage of phosphorus on density of phosphorus-nickel alloys. (1) Experimental values; (2) calculated for Ni_3P plus Ni; (3) calculated for Ni_2P_3 plus Ni; (4) calculated for Ni_3P plus Ni; (5) calculated for $NiP_{0.82}$ plus Ni

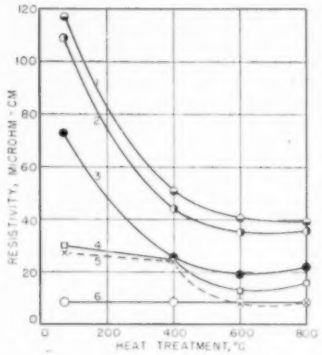


Fig. 8. Variations of resistivity of phosphorus alloys with temperature in a one-hour heat treatment. (1) Ni-H type bath, 13 per cent phosphorus in deposit; (2) Ni-H type bath, 10 per cent phosphorus in deposit; (3) Ni-H type bath, 7 per cent phosphorus in deposit; (4) Ni-L type bath, 2.2 per cent phosphorus in deposit; (5) Co-F type bath, 1.3 per cent phosphorus in deposit; (6) Bath Ni-L, but containing no phosphorous acid

to 1470° F (800° C). One point which has not yet been settled is whether it is possible to heat treat one of the alloys, for example at 1110 or 1470° F (600 or 800° C) and to cause it to increase in both ductility and hardness.

4. *Density*

As shown in Fig. 7, the density of phosphorus-nickel alloys decreases as the content of phosphorus in the deposit increases. The density of the deposits did not change appreciably as a result of heat treatment. Over the narrow range of composition shown, the relation between density and content of phosphorus is nearly linear, and the density—composition curve could be used to determine the composition of the deposit. The densities of several thermally prepared nickel phosphides are given in the literature[2,3]: Ni_3P, 7.8; Ni_2P_3, 7.4; Ni_2P, 7.2; $NiP_{0.82}$, 5.85. With these values for density, the theoretical curves for density against composition have been calculated for the nickel-phosphorus alloy and are represented in the figure by the solid lines.

5. *Electrical and Magnetic Properties*

The presence of phosphorus in the alloy considerably increases its resistivity above that of the pure metal. On heat treatment of the deposits, its resistivity decreased to a minimum at 1110° F (600° C). These relations are shown in Fig. 8.

No measurements have been made of the magnetic properties of the phosphorus alloys beyond testing them with a magnet. Cobalt deposits containing up to 10 per cent phosphorus are magnetic. Nickel deposits are nonmagnetic if they contain more than 8 per cent of phosphorus.

REFERENCES CITED

[1]Abner Brenner and Grace Riddell, J. Research Nat. Bur. Stds. 39, 385 (1947); 37, 1 (1946).

[1A]A. Brenner, P. Burkhead, and E. Seegmiller, J. Research Nat. Bur. Stds. 39, 351 (1947).

To be Continued

leaders in the industry xx

C. f. Nixon

One of the outstanding leaders in automotive plating, C. F. Nixon has been identified with the automobile industry almost continually since his birth. Born in Philadelphia, Pa., on May 4, 1901, he grew up in New Haven, Conn.; Buffalo, N. Y.; Columbus, Ohio; and Racine, Wis., all places where his automobile-body-building father moved with the then changing industry.

Mr. Nixon graduated from Racine High School in 1918 and after spending a year in a rubber laboratory entered the University of Wisconsin. Here he became interested in electroplating through the influence of his professor in electrochemistry, Dr. Oliver P. Watts. It was under Dr. Watts that he did his thesis work on dezincification of brass, published in the Transactions of the Electrochemical Society.

Graduation in 1923 with a B.S. degree in Chemical Engineering was followed by a six-year stint in the laboratory of the Western Clock Company in Peru, Ill. He then moved to Detroit for employment by the Ternstedt Division of General Motors Corporation, where he now holds the post of Director of Process Engineering.

A number of papers on electroplating subjects have emanated from Mr. Nixon's pen through the years. They have dealt with such things as solution analysis, *p*H of nickel baths, nickel-anode behavior, atmospheric and salt-spray corrosion, techniques in plating of zinc-base diecastings, and problems in copper-nickel-chromium plating. Of particular interest is Mr. Nixon's early use of the microscope in the study of the mechanism of outdoor corrosion, his pioneering work in the measurement of dragout and in the use of copper undercoatings on nickel-chromium plated zinc-base diecastings, and his development of a modified salt-spray test for plated zinc-base diecastings. His published contributions, which have appeared in PLATING or its predecessor, THE MONTHLY REVIEW, have earned him not less than four awards including the A. E. S. Gold Medal in 1949.

Realizing the benefits derived from membership in the American Electroplaters' Society, Mr. Nixon joined this Society soon after leaving school and attended his first convention, in Milwaukee, in 1924. He has been particularly active in its Detroit Branch, holding a number of offices. At present he serves as a very energetic President. In 1948 he was elected to the Executive Board of the Society and now holds the position of Second Vice-President and Membership Chairman. Those who have followed his activities on the Board can testify to his clear thinking on difficult problems and his willingness to work hard in carrying out decisions. He has been particularly interested in the promotion of the Society, and for that purpose has recently prepared a slide-illustrated talk which shows its manifold activities. It will be presented at all Branches.

A well-rounded personality, Mr. Nixon finds some time for relaxation, with music and with reading as well as on the golf course. In 1924 he married Charlotte Davis in Racine. They have one daughter, 14, and four sons, 18–24. The youngest son may follow in his father's footsteps, being a chemical engineering student at the University of Michigan.

LARGE SCALE FINISHING OF DIE-CASTINGS

This story, kindly furnished by Doehler-Jarvis Corporation through Mr. Maurice R. Caldwell, Assistant Vice-President, gives some idea of the magnitude of the operations and of the controls required to produce plated diecastings of high quality.

The diecasting method of parts manufacture has grown steadily in scope and importance. There are numerous reasons for this, of which the following are of special significance:

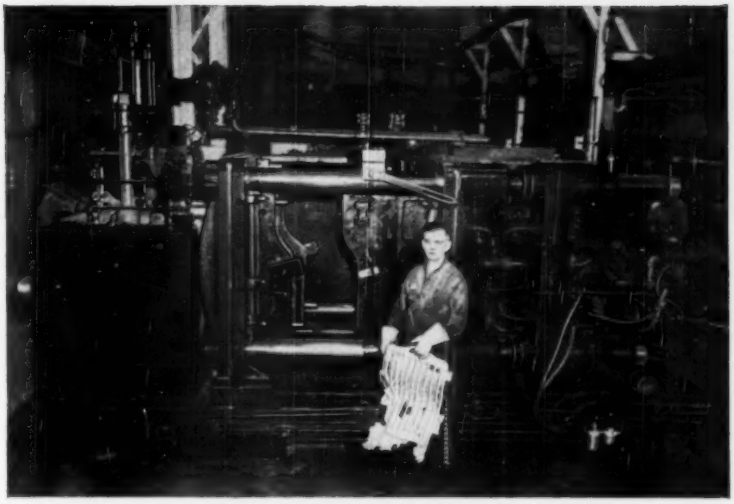
1. The method lends itself to rapid and economical repetitive production of from usually about 1000 parts to any desired number, generally with only nominal charges for upkeep of dies.
2. An almost infinite variety of shapes can be produced, including such that are so complex that a final assembly will consist of fewer pieces requiring a lesser number of operations than if other manufacturing methods were employed.
3. The parts can be provided with integral fastening elements to facilitate rapid assembly with mating parts, thereby eliminating the need for separate fasteners.
4. The method is capable of producing parts having such remarkably close dimensional limits and with holes so accurately cored that little if any machining is needed.
5. Sections may be made much thinner than by sand casting.
6. Parts can be had in numerous alloys affording a variety of properties to meet a wide range of requirements.
7. The physical properties of diecastings are superior to those of the same or corresponding alloys cast in sand molds.
8. Diecastings can readily be furnished with inserts of other metals or of nonmetallic materials, cast in place or applied afterwards.
9. The surfaces as cast may be so smooth and free from irregularities that the cost of finishing is low.
10. Diecast parts are capable of taking and retaining a variety of finishes, including electroplated and anodic finishes, as well as many types of organic finishes.

It is against this background that the Doehler-Jarvis Corporation during the last forty-five years has grown from acorn size to become the largest company in the diecasting industry. It now has six plants, in Toledo, Ohio; Grand Rapids, Michigan; Chicago, Illinois; Pottstown, Pennsylvania; and Batavia, New York. Of these, four are devoted to the production of diecastings and two to finishing.

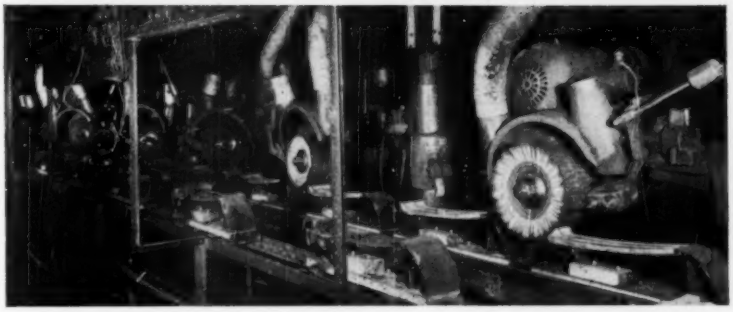
The Grand Rapids plant, in which most of the pictures were taken, is a finishing plant exclusively. It has eight straight-line and four rotary buffing machines, as well as numerous semiautomatics and single-purpose machines designed for buffing special parts. For plating there are four fullautomatic copper-nickel and four fullautomatic chromium plating units and a so-called still department for difficult parts that cannot be plated to required specifications in the automatics. In addition there are a fullautomatic nickel-chromium machine for plating brass stampings and a barrel zinc plating department.

The capacity of this plant is probably as large as that of any in the country, with an average of 300,000 diecastings being finished daily. Most departments are on a two-shift basis.

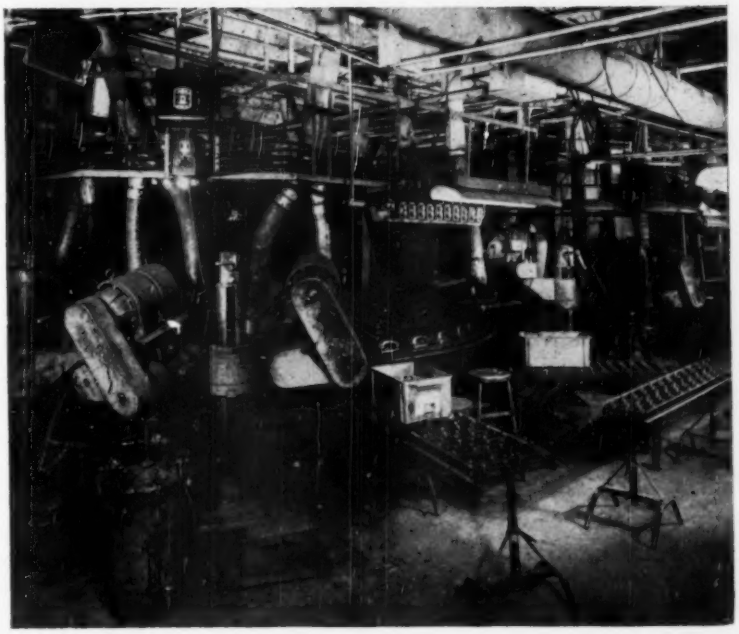
PLATING



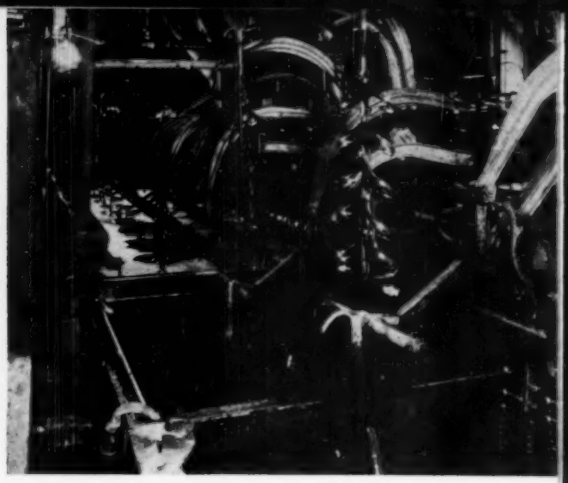
A large diecasting machine with the operator holding a casting. Present-day techniques make it possible to cast such large parts in zinc alloy and obtain sound castings which can be finished satisfactorily. Usually the only polishing is on the parting line. Trimming, filing and machining, if necessary, precede finishing to eliminate possibility of scratches.

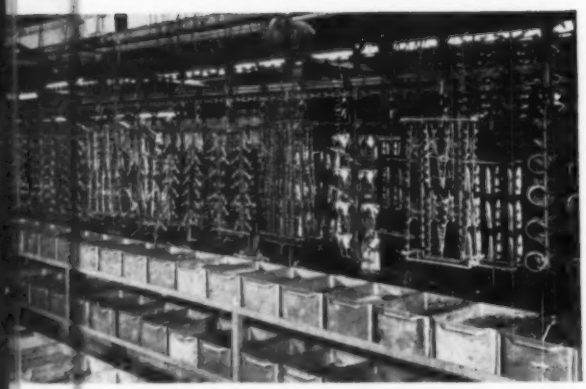


Straight-line buffing machines are employed for long parts. Many devices are used to hold the parts to the fixtures and to turn them from one side to the other as they progress down the line. The buffs are located in different positions and with different directions of rotation to permit complete buffing on the machine. Some parts have to be touched up on a hand buff. The cover picture shows another straight-line buffing machine.



Circular buffing machines with from 10 to 12 buffing heads are employed for small parts, such as door handles and window regulators. Use of liquid tripoli instead of bar compounds gives considerable material saving. Continuous operation requires three men: one for loading, one for unloading, and one to control the positions of the buffs.





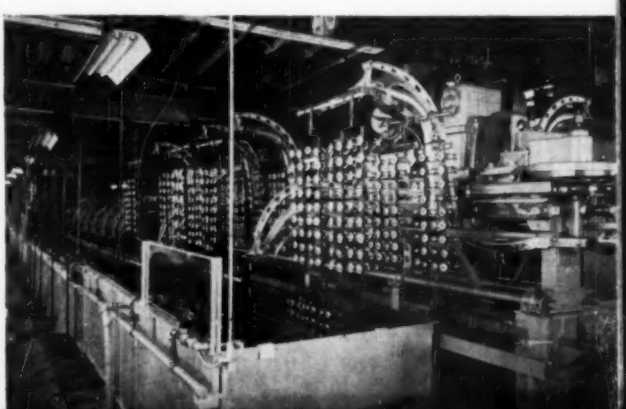
Above: A small portion of a racking and unracking section which feeds two fullautomatic plating machines. The light-weight diecast aluminum tote box, made in the Batavia plant, has replaced steel tote boxes throughout the Corporation and in plants of many other concerns.

Top left: View of nickel tank (empty) of a Hanson-Van Winkle-Munning elevator-type fullautomatic copper-nickel plating machine. Features include emulsion-type cleaning, cathode agitation, Duriron and Karbate heat exchangers, temperature controls, automatic solution-level controls. Total minimum thickness of copper plus nickel on indoor automotive hardware is usually 0.0005–0.00075 inch, on outdoor hardware 0.0008–0.0015 inch depending on the position of the part on the automboile and customer's requirement.

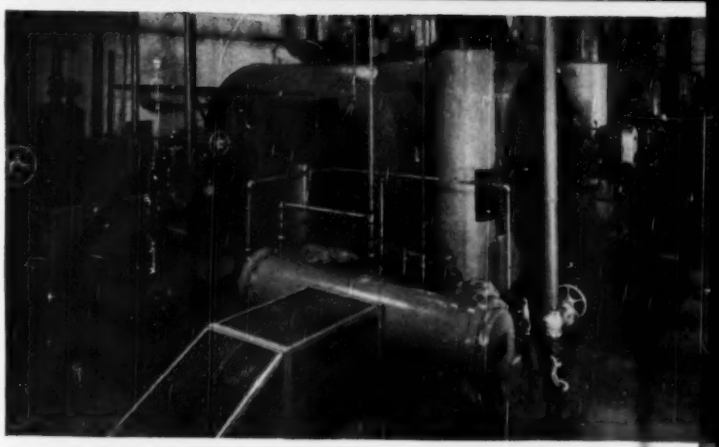
Top right: Section of a F. B. Stevens lift-arm-type fullautomatic machine for chromium plating. These units also are equipped with automatic temperature and solution-level controls.

Bottom left: Hoist line for plating special diecastings includes a cleaning cycle, five copper and seven nickel tanks. It is used for intricate shapes and parts requiring extra heavy plate thickness.

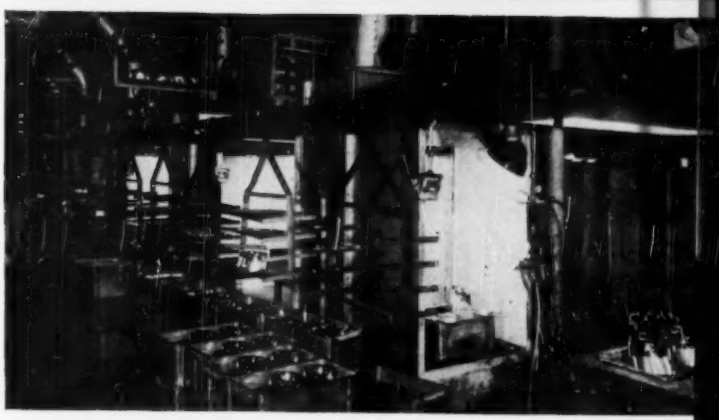
Bottom right: Lift-arm-type F. B. Stevens fullautomatic machine for nickel-chromium plating of brass stampings. It cleans, plates and dries daily from 80,000 to 100,000 stampings, which may be as-stamped, barrel burnished, or buffed.



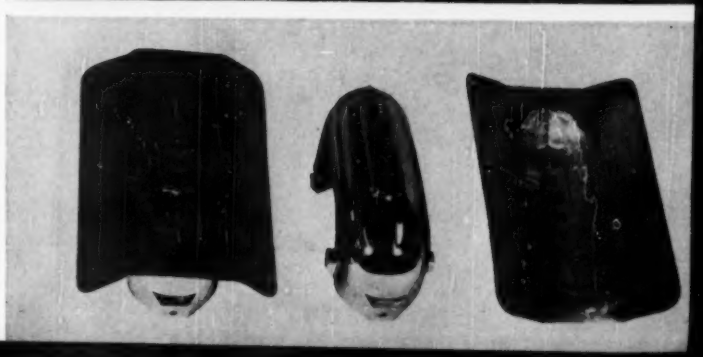
Line of motor-generators for one copper-nickel automatic. Most generators, largely 9-volt, 25° C temperature-rise units, are enclosed in dust-free rooms. Total amount of current required in the two finishing plants is about 300,000 amperes.



Partial view of steam-power plant showing four boilers. Each is capable of producing 500 boiler horse powers.

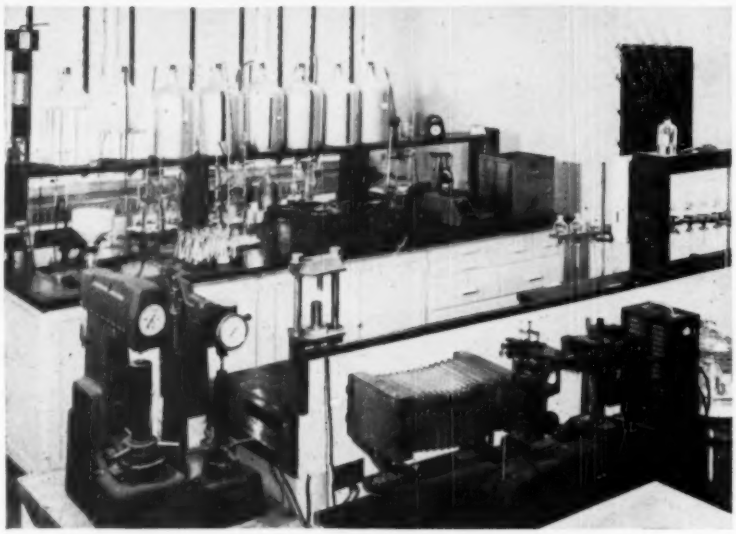


Many chromium plated diecastings are partially painted with synthetic-type paint and baked. This is a section of the paint room showing several water spray booths.

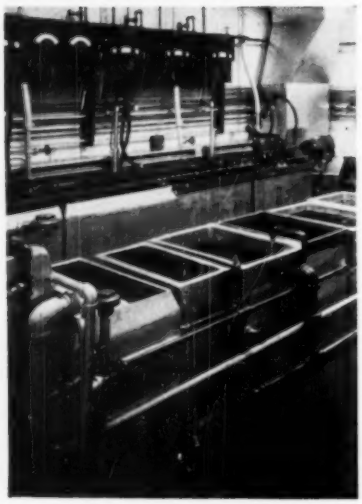


Paint shield with electroformed mask which fits the part perfectly so as to eliminate high-lighting by hand after spraying.

Successful production of zinc-base diecastings that will keep their physical properties and be suitable for plating requires that each heat be checked for impurities. Tin, lead, cadmium, iron, magnesium, aluminum and copper contents are kept within very close limits. This particular Bauch & Lomb quartz spectrographic equipment is located in the Toledo diecasting plant.



The analytical laboratory runs about two hundred analytical determinations daily and regularly determines plate thickness on all parts to make certain that customers' specifications are being met. Three girls and three men devote their time to such routine control or to experimental work.



Far left: Part of experimental-plating section. The tanks in the background hold 18 gallons each and serve for the second step following beaker experiments and for regular control of throwing power, deposit ductility and treatments required by copper and nickel baths in the plant.

Another section of experimental laboratory, with tanks holding 85 gallons, large enough to plate a rack of standard A.S.T.M. test pieces for outdoor exposure. They are also used in the third stage of development and checking of process before they are put into production.

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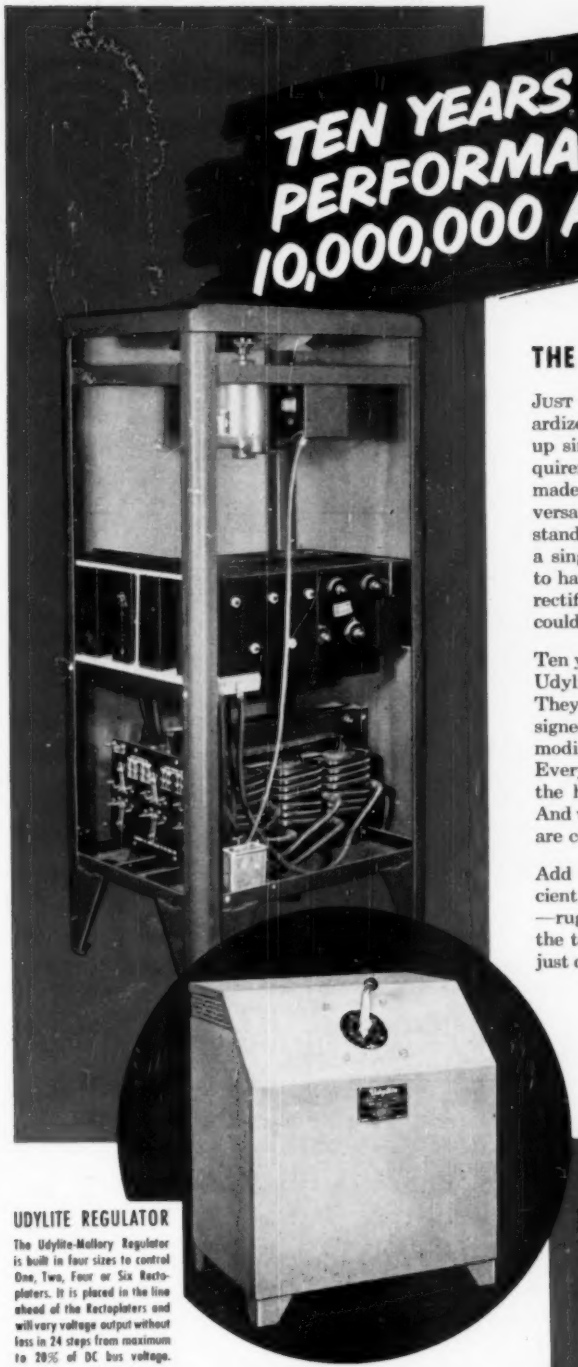

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PHOTOELECTRIC COLORIMETRY

RAFFAELE F. MURACA

Chandler Chemistry Laboratory, Lehigh University, Bethlehem, Pennsylvania

THE USE OF colorimetric procedures in analysis is such an accepted practice in modern technology that their application to electroplating baths, blood analysis, and many other problems is now familiar to all chemists. The photoelectric colorimeter is the indispensable tool in this form of analysis, and it is the purpose of this article to explain in simple terms the development, construction, and principle of operation of this instrument.

The various methods of estimating relative color intensities have already been discussed by Serfass and Levine[2], as well as by many others[1,3,4,5], and the laws of colorimetry have been concisely stated and discussed by these authors. Of interest in this discussion is Lambert-Beer's law only, which may be written mathematically as:

$$\log \frac{I_o}{I_t} = kcl$$

where $\frac{I_o}{I_t}$ is the ratio of the intensity of the incident light to that of the transmitted light that passes through a thickness l of a solution of concentration c. The constant k, called the extinction coefficient, is a characteristic of the colored substance and varies with the color of the light that is used, i. e., its wavelength. Generally, the extinction coefficient is of little use in practical colorimetry except that its presence in the expression for Lambert-Beer's law shows that this law is exact only when light of a single wavelength is used. Thus, one must use monochromatic (single-color) light or approach monochromaticity by the use of color filters if accuracy is to be achieved. This law holds only for clear solutions; turbid solutions scatter light and so reduce the intensity of the transmitted light to an incorrect value.

Visual colorimeters, such as the Duboscq unit (Fig. 1), are really color comparators, since they are used to determine when two solutions present the same color sensation to the eye. One of these solutions is of a known concentration of the substance being investigated, while the other solution is of unknown concentration. The depths of the solutions are adjusted until the colors match to the eye. When they match, then:

$$\frac{\text{Concentration of unknown}}{\text{Concentration of known}} = \frac{\text{Depth of known}}{\text{Depth of unknown}}$$

Obviously, the accuracy of this method depends upon the sensitivity of the eye, fatigue, experience, and colorblindness of the operator. In fact, all methods

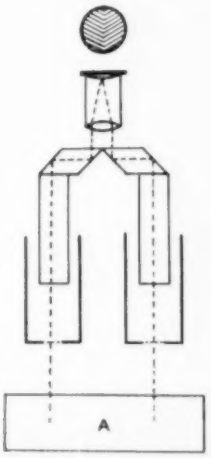

Fig. 1. Diagram of a Duboscq colorimeter. The depths of the solutions are varied until the field of vision is uniformly illuminated. (A) mirror

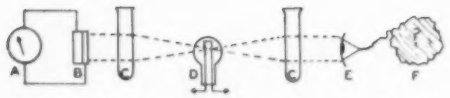

Fig. 2. Simple photocell circuit and analogy to human eye. (A) meter, (B) photocell, (C) tubes, (D) lamp, (E) eye, (F) brain

of optical comparison are subject to these errors. Nevertheless, visual colorimetry will give surprisingly accurate results in the hands of experienced operators.

The chief advantage of photoelectric colorimeters is the absence of the personal equation. The only remaining errors are those due to choice of method, dilution, sampling, etc., on the assumption that the errors present in photoelectric instruments can be made insignificant.

Direct-Reading Photoelectric Colorimeters

The simplest form of the photoelectric colorimeter is shown in Fig. 2 where an analogy to the human eye is also indicated. Just as the eye receives and relays to the brain the amount of light passing through the solution, the photocell receives light and generates a proportional amount of electricity that is transmitted to a meter.

By comparing the amount of light transmitted through a colorless solution to that transmitted through a colored sample, both the eye and the cell can perform the analysis. However, while the eye cannot distinguish between, say, 80 and 90 per cent transmission, the photocell meter is capable of giving numbers that are quantitatively related. The photocell used in this type of circuit is called a barrier-layer cell; it generates electricity from the light that falls upon it.

The simple photocell circuit of Fig. 2 has many disadvantages and is subject to many errors. First of all, the lamp voltage is unregulated. Since the main voltage may vary 10–15 per cent and the luminous intensity of a tungsten lamp varies as the *fourth* power of the voltage supply, it is obvious that the photoelectric current will be anything but steady during a measurement. The addition of voltage-regulating transformers will reduce voltage variations to about 1 per cent, but even this is objectionable for many purposes. The use of batteries is a plausible solution; however, it will be shown in the course of this discussion that the cost of their upkeep and replacement can be avoided by the choice of a suitable circuit design.

The operation of the device shown in Fig. 2 is rather simple. At the start, a tube containing only the clear solvent is introduced into the light path and the lamp rheostat is adjusted until the meter reads full scale. When the tube containing a colored substance is introduced, the amount of light reaching the photocell will be less than before and the meter deflection will be correspondingly lower. By introducing solutions of several known concentrations and plotting meter readings vs. concentration one obtains the required calibration curve. The unknown sample can then be analyzed by an analogous procedure.

The use of a light rheostat not only varies the intensity of light but also its color, making comparative measurements subject to error. Variable meter shunts in place of lamp rheostats have been used to avoid this source of error; however, even they can introduce errors due to the varying loads that are imposed on the cell. The effect in this instance is made evident by the nonlinearity of the response.

The color-temperature effect due to the lamp rheostat can be eliminated by use of an adjustable diaphragm. In this system, the lamp intensity is kept constant, and the amount of light reaching the photocell is controlled by an aperture diaphragm. One drawback that remains in all circuits in which photocells are employed is the necessity for sensitive galvanometers or delicate micro-ammeters to measure the feeble electric currents that are encountered.

This device uses uncollimated (nonparallel) light that is far from being monochromatic; as a result, Lambert-Beer's law cannot hold. Uncollimated light is objectionable since the refractive indices of the liquids in the sample and in the unknown may be different; the round tubes that are used in most colorimeters act as lenses and will illuminate different areas of the photocell, depending on the liquid in the tube. Since no photocell has a strictly uniform sensitivity over its whole surface, noticeable errors will be introduced. Flat-sided containers will eliminate the effect of uncollimated light. The polychromatic light emanating from the lamp can be made nearly monochromatic by the use of one of a series of light filters available for the instrument.

Consider a hypothetical compound having an absorption as shown in Fig. 3. This figure shows that when a light beam having all the wavelengths between 360 mμ and 720 mμ is passed through a solution of this compound, only the band of wavelengths between 480 mμ and 520 mμ will be absorbed. If this absorption

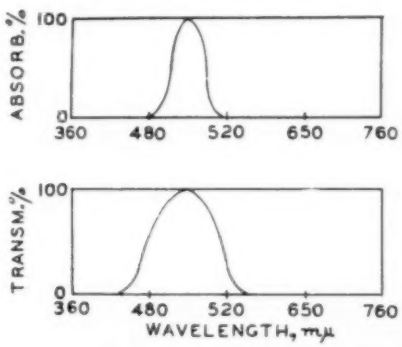

Fig. 3. Absorption curve of a hypothetical substance (top) and transmission curve of the correct filter for its analysis (bottom)

constitutes 10 per cent of the total incident light, the photoelectric colorimeter would not give a large deflection: it is insensitive. However, when a light beam containing only the wavelengths between 480 mμ and 520 mμ is passed through the same solution, all the luminous energy will be absorbed and the meter deflection will be full scale: the sensitivity of the colorimeter has been increased tremendously by the use of a filter. The relationship between the correct filter and the absorption of the solution is shown in Fig. 3.

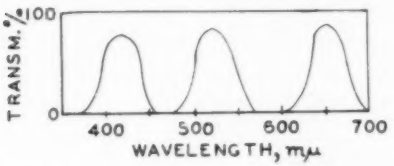

Fig. 4. Transmission curves of the three most used colorimeter filters. From left to right: blue, green, red

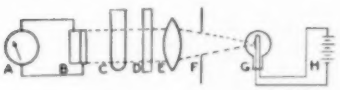

Fig. 5. Modified elementary photocell circuit. (A) meter, (B) photocell, (C) tube, (D) filter, (E) lens, (F) diaphragm, (G) lamp, (H) battery

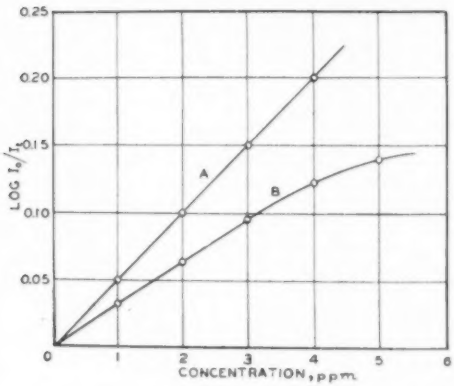

Fig. 6. Typical calibration curve (A). Type of curve when Lambert-Beer's law is not followed (B)

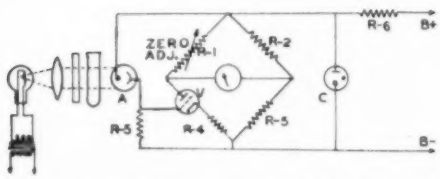

Fig. 7. Colorimeter circuit employing vacuum phototube (A), one vacuum-tube amplifier (V), and voltage-regulator tube (C). (D) is the meter, (B+) and (B−) leads to battery, (R-1) through (R-5) resistors

Another important purpose of filters is to block out the effect of other compounds. For instance, if another compound absorbing only around 650 mμ were also present, it would have no effect since light of that wavelength is not passed by the filter and no absorption could occur; thus, any decrease in transmitted light can only be due to a compound which absorbs light transmitted by the filter in question.

The transmission curves of several commonly used filters are shown in Fig. 4. Generally, filters are colored glass or gelatine plates that allow certain bands of wavelengths to pass and absorb the other wavelengths. The correct choice of filter is governed by the particular compound, for which the analysis is to be made. In general, the filter should transmit that portion of the spectrum that the solution absorbs. Thus, a red filter should be used for a blue solution and a blue filter should be used for a red solution. Occasionally, a solution that appears of one color to the eye actually absorbs most at some other color; for example, potassium permanganate solutions are red-violet to the eye but absorb strongly in the green. The choice of filter for such substances is best determined by inspection of their spectrophotometric curves.

The arrangement shown in Fig. 5 is more satisfactory than the rudimentary system in Fig. 2. It embodies most of the corrections that were suggested in the previous discussion. In spite of these improvements, even this system must be calibrated for every solution that is to be measured. For the calibration of the instrument, it is customary to plot the logarithms of the transmissions of a series of samples against their concentrations. The results are found to give a straight line, departing only if Lambert-Beer's law is not followed (Fig. 6).

A vacuum phototube, amplifier and meter can be used instead of the barrier-type cell and galvanometer. The diagram in Fig. 7 indicates the electrical circuit that replaces the simpler one in Fig. 5. Vacuum phototubes require an external voltage source for operation, the current flowing through the phototube being proportional to the amount of light falling on its sensitized surface. The current passed by the phototube flows through a resistor R-5 in Fig. 7, and the resulting voltage developed across the resistor ($E = IR$) is applied to the grid of a vacuum tube, V. Since the vacuum tube is in one leg of a bridge network, any change in the current flowing through V that is induced by the grid voltage upsets the bridge balance, and the meter indicates the degree of unbalance.

This circuit embodies another method of voltage control, viz., the use of a voltage regulator tube giving control within 1 per cent. For successful operation, the vacuum tube V must be operated along the

straight-line portion of its characteristic curve, and the tube should not show a change of characteristics with age. Although voltage control is incorporated in this design, no provision is made for controlling the filament voltage of the vacuum tube V, and large fluctuations of the mains voltage are reflected in an instability of the meter readings.

The circuits of Figs. 8 and 9 place less dependence upon the voltage stability of the bridge supply. They are examples of the so-called "balanced bridge circuit" that is widely used today. It can be shown that, theoretically, the circuit of Fig. 9 is twice as sensitive as that of Fig. 8, and this is sufficient reason to tolerate the use of a battery for the phototube supply. The drain on this battery is so small that its life in this circuit is essentially its shelf-life. When the circuits in Figs. 8 and 9 are near balance, they are relatively insensitive to voltage fluctuations because each vacuum-tube amplifier "sees" the same change and the bridge balance is not affected. Both of these circuits have exceptional sensitivity but are affected by variations of lamp intensity.

Differential Photocell Circuits

The primary prerequisite for the operation of all of the circuits that have been discussed up to this point is constancy of illumination. It has been indicated that the use of either a constant-voltage transformer or of a battery will give the desired result by makeshift and expensive methods. The "differential" photocell circuit in Fig. 10 obviates the need of a stabilized light source. Light from the lamp passes through identical lenses and filters and falls upon two matched photocells connected in series. Any variation in the light source causes equal and opposite currents to flow into the meter and cancel each other; the result is an insensitiveness to voltage fluctuation. In use, the solvent is placed in both tubes and the diaphragms are manipulated to give a zero reading on the meter. When a colored solution is put into one tube, the change in intensity of the light striking the one cell will cause a meter deflection. The meter is rebalanced by manipulating the other diaphragm which is calibrated in arbitrary units. Either photoemissive (barrier) or photovoltaic cells can be used in differential circuits as indicated in Figs. 10 and 11. The simplest method of getting identical optical systems for the differential circuit is to use the same filter, lens, and lamp. The optical systems shown in Fig. 12 indicate the methods used in various commercial colorimeters.

A drawback in the construction of differential photocell circuits is the necessity of having the two cells exactly matched with respect to aging characteristics, spectral and thermal response, and fatigue. However, modern production methods have tended to reduce this factor.

Most of the colorimeters that have been discussed so far employ a meter to read differences in light in-

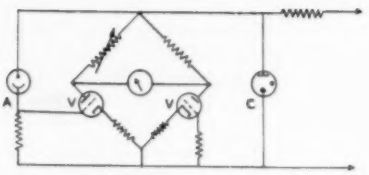

Fig. 8. Bridge circuit with vacuum phototube (A), two vacuum-tube amplifiers (V), and voltage-regulator tube (C)

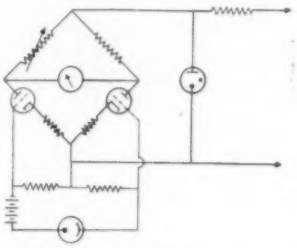

Fig. 9. Bridge circuit similar to that in Fig. 8 but twice as sensitive. Battery drain is negligible

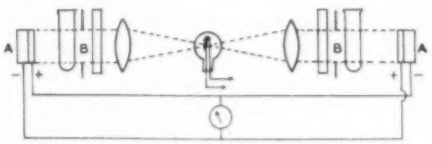

Fig. 10. Differential photocell circuit with photoemissive cells (A) and calibrated diaphragms (B)

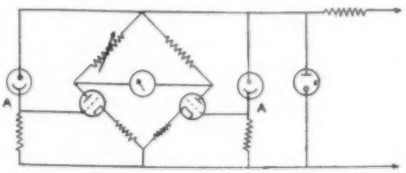

Fig. 11. Differential circuit using photovoltaic tubes (A)

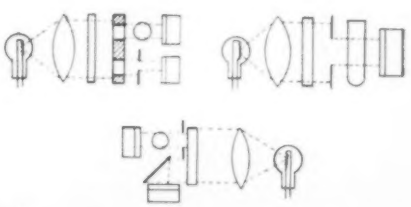

Fig. 12. Three optical systems used in commercial colorimeters

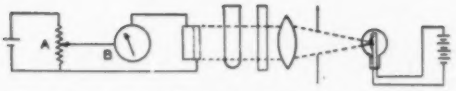

Fig. 13. Photocell circuit employing slide-back principle. (A) potentiometer, (B) galvanometer used as null instrument

tensities. A circuit using only one photocell and employing the so-called "slide-back" principle is shown in Fig. 13. Instead of the meter readings, the angular rotation of a potentiometer is calibrated. In this arrangement, the output of the photocell is balanced out by the application of voltage from the potentiometer. The galvanometer is merely used to indicate the balance point. A null instrument of this type is exceptionally linear since, at balance, no current is withdrawn from the photocell. The usefulness

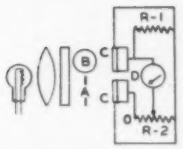

Fig. 14. Slide-back photocell circuit with diaphragm control. (A) diaphragm, (B) sample tube, (C) photoemissive cells, (D) null instrument, (R–1) constant resistor, (R–2) graduated slide-wire resistor

of this circuit as shown depends upon the stability of the battery, for the original calibration is meaningless if the potential of the battery shifts. Naturally, the voltage will drift and so the circuit is nearly useless for practical purposes.

However, the principle of the circuit of Fig. 13 can

TABLE I. CHARACTERISTICS OF COMMERCIAL PHOTOELECTRIC COLORIMETERS

The order in the table is of no significance; "P. C." is used as an abbreviation of photoelectric colorimeter

Name	Manufacturer	Circuit	Optics	Remarks
Evelyn P. C.	Rubicon Co., Philadelphia, Pa.	Fig. 5	Fig. 5	Rheostat is used for lamp control instead of diaphragm
Lumetron P. C. Series 400	Photovolt Corp., New York City	Fig. 5	Fig. 5	Either constant-voltage transformer or battery is used
Lumetron P. C. Model 402-E	Photovolt Corp., New York City	.....	Fig. 12 (bottom)	Circuit of Fig. 14 is used with one photocell connected in reverse
Klett-Summerson	Klett Mfg. Co., New York City	Fig. 14	Fig. 14	.....
Rouy Photrometer	E. Leitz, Inc., New York City	Fig. 5	Fig. 5	Photocell turning in light path is used instead of diaphragm
Lange P. C. Univ. Model II	Pfaltz & Bauer, Inc., New York City	Fig. 10	Fig. 10	.....
Brociner-Mass Clinical Analyzer	Brociner-Mass Insts., Inc., New York City	Fig. 5	Fig. 5	Rheostat for lamp control is used instead of diaphragm
Fisher Electro-Hemometer	Fisher Scientific Co., Pittsburgh, Pa.	Fig. 5	Fig. 5	Rheostat for lamp control is used instead of diaphragm; has built-in filter for blood
Fisher Electro-photometer	Fisher Scientific Co., Pittsburgh, Pa.	Fig. 15	Fig. 12 (bottom)	.....
Coleman Junior Spectrophotometer	Coleman Insts., Inc., Maywood, Ill.	Fig. 5	.....	Embodies a simple monochromator
Coleman Photo-Nephelometer No. 7	Coleman Insts., Inc., Maywood, Ill.	.....	Fig. 16	.....

be used if the battery is replaced by a photocell. The arrangement is shown in Fig. 14. At the start, a tube containing pure solvent is put in front of one photocell; with the slidewire at zero, the diaphragm in front of the other cell is manipulated until the galvanometer reads zero. Obviously, both cells must be receiving the same amount of light and the voltage developed across each resistor will be the same. If the tube with the solvent is replaced by a tube containing a colored solution, the sample photocell will receive less light and the voltage developed across the resistor R-1 is less than that across R-2. Consequently, the slide must come down on R-2 to pick off a lower voltage to balance the galvanometer. The slide-wire readings are calibrated against standard solutions. Naturally, this system is self-compensated for line-voltage changes, for it embodies the principles of a differential circuit. Generally, the slide-wire drum is calibrated logarithmically so that its readings are directly proportional to concentration; a plot of dial readings vs. concentration will thus give a straight line. Although the circuit in Fig. 14 is operationally the same as the one in Fig. 13, the cells in Fig. 14 must always deliver current while that in Fig. 13 does not deliver current at balance.

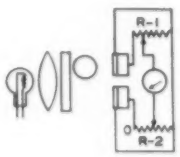

Fig. 15. Slide-back photocell circuit with electrical compensation. (R-1) variable resistor for initial balancing, (R-2) graduated slide-wire resistor

The circuit in Fig. 15 is similar to the one in Fig. 14 except that it is electrically compensated, i. e., the initial balance is achieved by the use of the variable resistor R-2 instead of a diaphragm. Other schemes of achieving the initial balance involve the use of variable lamp distance, Polaroid discs, and variable light intensity.

Table I summarizes the circuits employed in commercially available instruments. The order in the table is random and is not to be taken as indicative of the relative merits of the instruments.

Turbidimeters, Nephelometers, and Fluorophotometers

These instruments involve the same electrical and optical systems as are used in colorimeters. It is a relatively simple matter to transform one from the other by minor changes.

Turbidimeters are used for measuring the transmission of stable suspensions. In general, any colorimeter may be used for this purpose. Since the relation of concentration of a suspension to transmission is quite complex and not necessarily linear, it is absolutely necessary to calibrate the instrument for each analytical method.

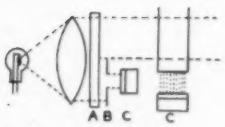

Fig. 16. Nephelometer diagram. (A) filter, (B) (B) diaphragm, (C) photoemissive cells

The principle of the nephelometer is indicated in Fig. 16. In this case, the light that is reflected at right angles from the suspension is measured. This light comes from the reflection of incident light by the particles in suspension.

In fluorophotometry, the instrument that is employed is identical with a nephelometer except that an intense beam of monochromatic ultraviolet light is used for illumination of the sample. Special photocells may be necessary in some instances.

Certain substances fluoresce, i. e., transform the invisible ultraviolet light to visible light, and the solution under test is thus made to "glow", or fluoresce. The amount of fluorescence is proportional to the concentration of the substance present and is measured by the photocell. Fluorophotometers have been used extensively in the assay of certain vitamins like riboflavin (B_2) and thiamin (B_1).

Errors in Photoelectric Colorimetry

Although the photoelectric colorimeter has greatly reduced the errors that are common to visual-comparison methods, many other causes for error still remain. A most common error that has been frequently overlooked is stray light. In general, the design of modern colorimeters prevents this error; nevertheless, a colorimeter must not be used in direct sunlight or where strong light may fall on the sample cells. Dust may interfere by entering the lens systems, or chemical films may coat the whole optical system. Temperature affects the stability of the instrument, so that the lamp should be turned on for a few minutes to allow the mechanical, electrical, and optical components to come to equilibrium before measurements are made. Barrier photocells are usually rendered unstable or even destroyed by excessive heat.

Another source of error is the sample tube. Since test tubes are sometimes used in colorimeters and are subject to wide variation in wall thickness as well as tube diameter, the same tube should be used for standardization and measurement. This tube should be carefully selected by repeated trials in the colorimeter; rotation of the tube should have no effect on the meter deflections. Although the errors can be kept to

(*Continued on page 68*)

PREPARATION OF HIGH-CARBON STEEL FOR ELECTROPLATING[1]

— a tentative recommended practice —

A. S. T. M. Designation: B242–49T Issued, 1949[2]

This Tentative Recommended Practice has been approved by the sponsoring committee and accepted by the American Society for Testing Materials in accordance with established procedures, for use pending adoption as standard. Suggestions for revisions should be addressed to the Society at 1916 Race Street, Philadelphia 3, Pa.

Scope

1. (a) This recommended practice is intended as an aid in establishing and maintaining a preparatory cycle for electroplating on high-carbon steel (Note) which will reduce hydrogen embrittlement to a minimum and will secure maximum adhesion of the electrodeposited metal. For the purpose of this recommended practice steels containing 0.35 per cent of carbon or more, and case-hardened low-carbon steel, are defined as high-carbon steels. There is no generally recognized definite carbon content dividing high- from low-carbon steels for electroplating purposes.

Note.—Electroplating of plain high-carbon steel introduces problems not found in similar operations on low-carbon steel. During the cleaning and plating cycle high-carbon steel differs from low-carbon steel in regard to its greater tendency to become embrittled and the greater difficulty in obtaining maximum adhesion of the electrodeposit. The preparation of low-carbon steel for electroplating is covered in the Tentative Recommended Practice for Preparation of Low-Carbon Steel for Electroplating (A. S. T. M. Designation: B183)[3].

(b) This recommended practice does not apply to the plating of alloy steel. For methods of chromium plating directly on steel see the Recommended Practice for Chromium Plating on Steel for Engineering Use (A. S. T. M. Designation: B177)[3].

Nature of Steel

2. (a) *Hardness.*—High hardness is a major cause of cracking of the steel during or after plating. The recommended maximum hardness range for classes of products depends on their geometry and service requirements (Note). Parts hardened by heat treatment should be inspected before plating for the presence of cracks by a suitable method, such as magnetic or fluorescent powder inspection.

Note.—Some examples of parts and Rockwell hardness ranges are as follows:

	Rockwell Hardness Range
Springs	C45 to C48
Spring washers	C45 to C53
Small instruments parts	C52 to C55
Parts to be chromium plated for engineering use	C57 to C62

(b) *Hydrogen Embrittlement.*—Difficulties resulting from hydrogen embrittlement increase with increasing hardness, whether produced by heat treatment or cold-work. Difficulties, during or after plating of hardened high-carbon steel parts, may in some cases be minimized without material change in hardness by baking at 400° F (205° C) in a suitable medium for at least ½ hour at temperature.

(c) *Surface Oxidation.*—In order that subsequent treatments be facilitated, every reasonable precaution should be taken throughout the processing to limit oxidation or scale formation. In particular cases preplating with copper to a minimum thickness of 0.0005 inch may assist in maintaining a preferred surface through the heat treatment. A nonoxidizing atmosphere should be maintained in the furnace. This copper is to be removed prior to the regular plating cycle. Care should be used in oil-quenching parts heat treated in a salt bath, to prevent the charring effect that can be caused by salt bath drag-out. Proper lead-bath quenching results in only slight oxidation.

(d) *Steel Quality.*—The quality of the steel should be characteristic of the requirement of the product

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[1]Under the standardization procedure of the American Society for Testing Materials this recommended practice is under the jurisdiction of the A. S. T. M. Committee B-8 on Electrodeposited Metallic Coatings.

[2]Accepted by the American Society for Testing Materials at annual meeting, June, 1949. Approved by American Electroplaters' Society through its Executive Board, November, 1949.

[3]1949 Book of A. S. T. M. Standards, Part 2.

and the plating operation. The steel should be free from injurious surface defects and of at least average cleanliness.

Preparation of Steel, General

3. (a) *Preparatory Treatments.*—A wide variety of surface conditions are encountered in high-carbon steel articles to be electroplated. The surface may require the removal of one or more of the following contaminants: grease, oil or drawing compounds, burned-in oil scale, light to heavy treatment scale, permeable oxide films, emery and fine steel particles resulting from the grinding operation. The removal of such contaminants is accomplished by one or more of the following pretreatment procedures where applicable:

(1) Substantial removal of oil, grease, and caked-on dirt by precleaning before the part enters the plating cycle (applicable in all cases).

(2) Mechanical treatment of the surface by tumbling, sand or grit blasting, vapor blasting, or grinding (optional).

(3) Final and complete anodic cleaning in an electrolytic alkali cleaner.

(4) Acid treatment in hydrochloric acid to remove the last trace of oxide and scale. This should be avoided for spring temper and case-hardened parts. This treatment also removes residual traces of lead that may be present following proper lead-bath quenching.

(5) Smut removal by cyanide dipping or by anodic treatment in cyanide or alkali.

(6) Final preparation for plating may be accomplished by an anodic etching treatment in sulfuric acid (used whenever possible in the interest of high yield and adhesion).

(7) Conditioning of the surface to be plated may be accomplished, where necessary for the plating process, by a short dip or rinse in a solution equivalent to the plating solution without its metallic content.

(b) *Rinsing.*—Inadequate rinsing after each solution treatment step is the recognized cause of a large portion of plating difficulties. Not enough rinsing is done in most pretreatment cycles.

(c) *Pretreatment Time.*—All processing steps involving hydrogen generation must be designed to operate for a minimum length of time, in order to assist in limiting hydrogen embrittlement of the high-carbon steel.

(d) *Control.*—All pretreatment steps should be carried out with solutions that are maintained in good working condition by control of composition and contaminants, and used under conditions of time, temperature and current density specified to meet the requirement of the work being processed.

(e) *Pretreatment Cycle Design.*—Depending upon the requirements for the particular high-carbon steel parts to be plated, a minimum cycle should be selected from the general steps listed in Paragraph (a). Different classes of materials require selected process steps combined into pretreatment cycles of greater or lesser complexity according to the condition and properties of the material. The minimum number of steps necessary to accomplish the plating satisfactorily is recommended.

Preliminary Pretreatment Procedures

4. (a) *Application.*—Degreasing and mechanical surface treatment are necessary only where the high-carbon steel parts are grossly contaminated to such an extent that otherwise the burden imposed on the pretreatment cycle would impair its efficiency, increase its complexity, and tend to prevent the attainment of the required quality of plating. The overall cost of the plating process is usually reduced by using the preliminary treatments where applicable. Oil, grease, dirt, drawing compounds, burnt-in oil, heavy scale, emery and steel particles are typical of the gross contaminants encountered.

(b) *Precleaning.*—Solvent-degreasing with clean solvent, spray washing, or emulsion cleaning, followed by electrolytic or soak alkali cleaners are recommended. The former types are preferred to reduce the burden on the alkali treatments. Soak alkali cleaning is usual for parts that are to be barrel-plated. Electrolytic cleaning should always be anodic where the control of embrittlement is a problem.

(c) *Stress Relief Treatment.*—Low-temperature heat treatment for ½ hour at a temperature of 400 F (205 C) is recommended for all hardened high-carbon steel parts. This should be done before the parts are mechanically pretreated, or enter the final pretreatment cycle, or both.

(d) *Mechanical Treatment.*—The purpose of mechanical treatment is to reduce subsequent acid pickling to a minimum. Where mechanical treatment has been accomplished with precision, it is sometimes possible to eliminate acid pickling entirely, thus improving the control of hydrogen embrittlement. When required, mechanical treatment of small parts is best effected by tumbling. All scaled and nearly all oil-quenched materials require mechanical cleaning such as by tumbling with or without abrasive, or by sand, grit or vapor blasting. These operations should be carried out so as to avoid severe roughening of the surface with accompanying notch effect. Grinding is resorted to in certain cases where the surface smoothness or dimensions of the parts are of critical importance, for example, in chromium plating for engineering use.

Final Pretreatment Procedures

5. (a) *Application.*—Final cleaning, oxide removal and etching are fundamental steps required for preparing high-carbon steel for electroplating. These pretreatment steps are designed to assist in the control of hydrogen embrittlement and in securing the maximum adhesion of the plated coating.

(b) *Electrolytic Anodic Cleaning.*—All work, except

work to be barrel-plated, should preferably be cleaned in an electrolytic anodic alkaline cleaner. Anodic cleaning is recommended to avoid hydrogen embrittlement that is likely to result from cathodic cleaning. An exception is barrel-work, which because of the work size is preferably cleaned by soaking or tumbling in an alkaline cleaning solution without the use of current.

The purpose of this cleaning step is to remove completely the last traces of contaminants. In all cases it should be preceded by heavy duty precleaning as covered in Section 4 (b).

The electrolyte anodic cleaner should be used at a temperature of 190° F or higher, and at a current density of 50 amp per sq.ft. or higher, in order that the required degree of cleanliness be obtained in a time period not exceeding 2 min.

On removal from the cleaner, the work should be thoroughly rinsed, first with water warmed to 120° F and then in a cold water spray at room temperature, prior to the acid dip.

(c) *Rinsing.*—The most thorough fresh water rinsing operation possible is mandatory after each processing step if the best results in plating high-carbon steel are to be obtained. The purpose of rinsing is to eliminate dragover by complete removal of the preceding solution from the surface of the work. Many existing commercial operations are characterized by inadequate rinsing.

Warm to hot rinses should be used following alkaline solutions or where the subsequent processing solution is hot. The rinse temperature should not be so high as to induce drying of the steel surface between processing steps. Room temperature rinses are suitable for use following acid solutions where the solution in the next processing step is cold. In no case should very cold water be used for rinsing.

The recommended rinsing practice includes the use of an immersion rinse followed always by a spray rinse of fresh water at the required temperature. The nonuse of spray rinsing is an invitation to trouble in the plating of high-carbon steel.

(d) *Hydrochloric Acid Treatment.*—The purpose of the hydrochloric acid treatment is to remove completely the last trace of oxide from the surface of the high-carbon steel. The intensity of hydrochloric acid treatment should be held to the minimum required by the nature and amount of oxide present. The use of sulfuric acid instead of hydrochloric acid is not recommended for descaling high-carbon steel because of its smut-forming tendency, in spite of the somewhat lowered tendency to rusting of sulfuric acid treated surfaces. The addition of wetting agents to the hydrochloric acid solution is not recommended. Care and caution must be exercised in the use of inhibitors where they are required, since they sometimes interfere with adhesion. Inhibitors are of benefit only in special cases where surface finish and dimensions are of prime importance.

(e) *Treatment for Smut Removal.*—Where the condition of the high-carbon steel results in the presence of smut after the hydrochloric acid treatment, the smut must be removed before the surface is electroplated. Light oxides formed on exposure to air after acid treatment must likewise be removed. This can be done by an anodic cyanide or alkaline treatment. Air-formed oxide, if not too heavy, can be removed by a cyanide dip after the rinse following the acid treatment. A concentration of 3 oz/gal (22.5 g/l) of sodium cyanide is sufficient for the cyanide dip. Where a severe smut condition exists, it can be eliminated by a ½–1 min anodic treatment at 15–20 amp per sq.ft. in a solution of sodium cyanide of the noncritical concentration of 6 oz/gal (45 g/l), used at room temperature. An alternative treatment for a somewhat lighter smut condition is electrolytic anodic treatment in the noncyanide alkaline cleaning solution (Paragraph (b)) above 160° F (71° C), for 15–30 sec at 25–50 amp per sq.ft. The current density is not critical.

(f) *Etching.*—The use of an anodic acid etch and subsequent rinse as final steps in the preparation for plating of high-carbon steel is of importance in securing adhesion. Without such an anodic treatment, poor adhesion may occur. The anodic acid treatment is capable of removing a small amount of smut formed by the preceding hydrochloric acid treatment; more substantial amounts of smut should be removed according to the procedures described in Paragraph(e).

A sulfuric acid solution containing from 250–1000 g/l at a temperature of not more than 86° F (30° C) and preferably below 77° F (25° C) is effective for anodic etching of high-carbon steel. The addition of 125 g/l of sodium sulfate (based on the anhydrous salt) is of benefit for many steel grades. Anodic treatment in this solution for a time usually not exceeding 1 min at a current density of 150 amp per sq.ft. (range of 100—400 amp per sq.ft.) is sufficient. A high acid content, high current density and low temperature (with reference to the ranges specified) will minimize the attack on the base metal and produce a smoother surface. This sulfuric acid etch solution is very stable and not affected appreciably by iron build-up. Besides securing adhesion of the subsequent electroplate, it improves the uniformity of the plate and reduces hydrogen embrittlement.

A dip for 5–10 sec in 5 per cent nitric acid solution, followed by rinsing and anodic cyanide treatment for smut removal, has in certain cases been found effective. Although nonelectrolytic, the nitric acid treatment requires an additional electrolytic cyanide treatment before plating. Electrolytic polishing, although not widely used commercially, appears promising as an alternative etching procedure. Likewise, anodic treatment in very strong phosphoric acid-sulfuric acid mixture is of interest in view of its known ability to remove carbon from cast iron surfaces.

(*Continued on page 68*)

project no. 2

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*AUTHORS

Determination of Impurities in Electroplating Solutions

XVI. TRACES OF CHLORIDE IN COPPER PLATING BATHS

Introduction

The purpose of this investigation was to develop a quantitative procedure for the determination of chloride in copper baths which might be contaminated with Pb, CrO_3, Fe^{+++}, Ca, Al, Ni, Na, SiO_2, and organic material.

There have been many quantitative procedures developed for the analysis of chlorides, the chief among these being the Volhard, Fajans, and the Mohr titrimetric methods and the gravimetric procedure of weighing AgCl. The Mohr method consists of the titration of the chloride ion with a standard $AgNO_3$ solution using K_2CrO_4 as the indicator and the end point indicated by the formation of reddish brown Ag_2CrO_4. The Volhard method involves the addition of an excess of Ag^+ ions and the back titration with SCN^- using ferric ions as the indicator. The major difference between the Fajans and the Mohr method is that the indicator is an organic acid which is adsorbed on the AgCl precipitate[16-18]. The majority of the micro methods for the determination of chlorides are based upon these procedures and modifications of them.

The Mohr method has been used fo, analyses of fresh and sea water[10-11-15-19] the Volhard method for analyses of beamhouse liquors, blood, cerebrospinal fluids, sea water, and foods[1-7-8-15]. A recent modification whereby the AgCl precipitate does not have to be removed has greatly simplified the Volhard method[2-9]. The Fajans method has been used for biological fluids, and new indicators have recently been developed for this titration[12-18].

A new titrimetric method has been developed in which mercuric nitrate with diphenyl carbazone or sodium nitroprusside is used as the indicator, and this has been used for blood analyses[13].

The gravimetric method with the precipitation of AgCl has been used in the analysis of Cl^- in cyanide baths[21] and in certain organic compounds[20].

Nephelometric and conductometric methods have also been used for blood, urine, serum, cerebrospinal, and water analyses[6-14].

Although these methods can be used to determine micro quantities of chloride, the amount of chloride present in copper plating baths is beyond the range of the accuracy of either the volumetric or gravimetric methods. The concentration of chloride ion in this investigation ranges from 0 to 300 ppm. To obtain a quick and simple method with an accuracy of approximately 5 per cent colorimetric methods for chloride analyses were next investigated.

According to the literature, resorufin and o-toluidine have been used for the determination of small amounts of free chlorine in solutions[3-4]. O-toluidine has been proposed for chlorine determination in disinfectants, but other oxidizing

agents will also react and interfere with the test. Dimethyl-p-phenylene diamine hydrochloride has also been used as a colorimetric reagent for chlorides[22].

Developmental Work

Although turbidimetric methods have been used for the determination of chlorides, it was thought best to consider them only as a last resort. Such methods are only reliable if the conditions of the precipitation are exactly reproduced, a very difficult thing to do.

A very simple method could be devised if the silver method could be applied for the chloride determination. In this determination a known amount of Ag^+ would be added and the remaining Ag^+ that had not reacted with the chloride would be analyzed according to the silver method[17].

Before this method was attempted, several factors had to be studied.

A. *Solubility of the Precipitated AgCl*

Whenever a method is used involving a precipitation, the error that will be introduced due to solubility of precipitate must be calculated.

The amount of silver ion in solution after the precipitation of AgCl is due not only to the excess of Ag^+ ion which is added, but also to the Ag^+ resulting from the solubility of precipitated AgCl. The latter silver source must be regulated so that the error introduced will be a minimum. Having calculated the solubility of AgCl, we found it best to precipitate AgCl from a solution containing a large excess of Ag^+ ions. In this way, the amount of added excess Ag^+ ions in solution will be large compared to the Ag^+ ions present from the precipitated AgCl and the error introduced in the method will be reduced to a minimum, as shown by the following example.

Calculations:

Ag_t = total number of moles of Ag added
Ag_s = moles of Ag precipitated as AgCl
Ag_r = moles of Ag in solution from the solubility of AgCl
Ag_o = excess Ag^+ in solution
Cl_t = total number of moles of Cl added
Cl_s = moles of Cl precipitated as AgCl
Cl_r = moles of Cl in solution from the solubility of AgCl

Then,

$$Ag_t = Ag_o + Ag_r + Ag_s$$
$$Cl_t = Cl_s + Cl_r$$

Since

$$Cl_s = Ag_s$$
$$Cl_s = Cl_t - Cl_r$$
$$Ag_s = Ag_t - Ag_r - Ag_o$$
$$Cl_t - Cl_r = Ag_t - Ag_r - Ag_o$$

Since

$$Cl_r = Ag_r$$

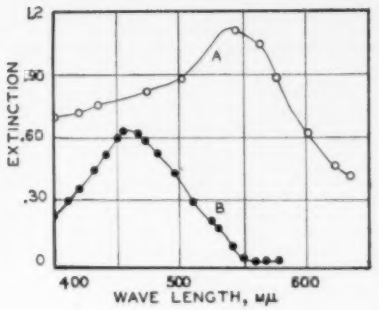

Fig. 1. Extinction vs. wave length for (A) cupric dithizonate, (B) silver dithizonate, both in carbon tetrachloride

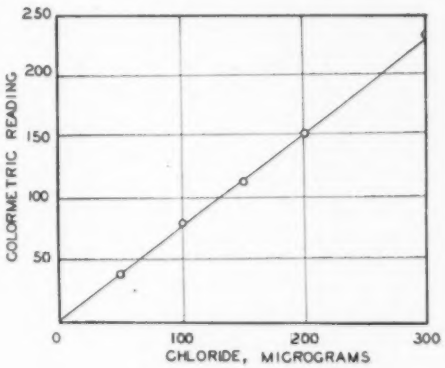

Fig. 2. Calibration curve for determination of chloride ion by silver dithizonate-cupric dithizonate method. Klett-Summerson colorimeter with green No. 54 filter. Total volume 25 ml

$$Cl_t = Ag_t - Ag_o$$
or $$Ag_o = Ag_t - Cl_t$$

What will be the error introduced from the Ag^+ in solution from the precipitated AgCl, when 1000 micrograms of Ag^+ is added to 10 ml of solution containing 150 micrograms of Cl^-?

1000 micrograms of Ag = 9.2 microequivalents of Ag
150 micrograms of Cl = 4.0 microequivalents of Cl

$Ag_o = Ag_t - Cl_t$

$Ag_o = 9.27 - 4.23 = 5.04$ microequivalents/10 ml or 5.07×10^{-4} mole/l

$[Ag_r + Ag_o]\ [Cl_r] = 1 \times 10^{-10}$

Since $Ag_r = Cl_r$

$[Ag_r + Ag_o]\ [Ag_r] = 1 \times 10^{-10}$

$Ag_r^2 + 5.04\ Ag_r \times 10^{-4} - 1 \times 10^{-10} = 0$

$Ag_r = 2 \times 10^{-7}$ mole/l = 0.002 microequivalent/10 ml

and the error introduced will be

$100 \times 0.002/4.23 = 0.047$ per cent.

From this calculation it is seen best to carry out the precipitation in 5 ml of a copper plating bath containing 0–300 micrograms chloride and 1000 micrograms of added silver ion, and to take an aliquot of the solution from the centrifuged precipitate and proceed with the analysis for silver. The error will be kept within 1 per cent in most cases.

B. *Conditions of Precipitation*

The next step in the development of this method was to obtain the best method for the precipitation of AgCl. The best results are obtained in the presence of dilute HNO_3, but since HNO_3 will oxidize the dithizone in a later step, this cannot be used. As AgCl precipitates best on the acid side, 1 ml of 5-*N* H_2SO_4 is used in the precipitation of AgCl.

C. *Interfering Ions*

Other halides, Br^- and I^-, will naturally interfere with the chloride determination. It was decided to determine the total halide content. For accurate chloride analysis, the bromide and iodide ion can be removed in various ways[1-6,11,29]. Also cyanide, ferrocyanide, and ferricyanide must be removed before this determination is made.

With the above considerations, it was thought that the silver method could be used for the chloride determination. In the silver method[17] there are several factors which must be controlled, the important one being the time of shaking. The 10-second shaking period is critical and should be checked with the second hand of a watch. Another factor is that the copper be in excess, which it is in all copper plating baths.

TABLE I. CALIBRATION CURVE DATA

Cl^- Added micrograms	Colorimeter Readings	Average Reading	Blank Reading	Corrected Reading
0	210, 215, 220	215	215	...
50	255, 257, 253	255	215	40
100	295, 296, 295	310	215	80
150	330, 331, 331	331	215	116
200	368, 370, 372	386	215	155
300	450, 455, 452	452	215	237

TABLE II. IMPURITIES ADDED TO PURE COPPER BATH

Impurities	Quantity Added mg/100 ml	Concentration g/l
Aluminum	100	1.0
Calcium	saturated	saturated
Chromic oxide	20	0.2
Lead	5	0.05
Iron	100	1.0
Nickel	100	1.0
Silica	100	1.0
Sodium	200	2.0
Sugar	1000	10.0

As seen from the absorption curves of copper and silver dithizonate in Fig. 1, the greatest absorption occurs at 560–580 mμ. A Beckman spectrophotometer was used to determine this curve. If a spectrophotometer is used for the analysis, the wave length used should be 570 mμ, while if a colorimeter is used a green filter No. 54 is adequate.

The calibration curve was constructed according to the Recommended Routine Procedure given later in this article. Chloride ion in amounts of 0, 50, 100, 150, 200 and 300 micrograms was added to 5-ml samples of pure copper bath. The data obtained are given in Table I and the straight line obtained by plotting chloride concentration versus colorimetric reading is given in Fig. 2. This curve shows that the Beer-Bouguer's Law is obeyed.

Accuracy and Precision of the Method:

A calibration curve having been established for the determination of chloride in a pure copper bath, the accuracy and precision of the proposed method could be checked.

To determine the accuracy under conditions similar to those that might be met with industrially, small amounts of various metallic salts were dissolved in 100 ml of the pure copper bath and the accuracy was determined in the presence of these impurities by the same method that was used in obtaining the calibration curve. The kind and quantity of the various substances are given in Table II.

The silica was added in the form of $Na_2SiO_3.5H_2O$ and the metallic ions as sulfates or nitrates. A slight precipitate was formed when these impurities were added even though the solution was carried out at room temperature to minimize hydrolysis of the iron. This insoluble material was removed by filtration with a No. 40 Whatman filter paper. The impure bath had a greenish cast due to the chromium present.

The accuracy of the method was tested by adding 100, 200, and 300 micrograms of chloride to 5 ml of the impure bath and analyzing for chloride concentration. The results of these analyses are given in Table III.

The average accuracy of the method from these results is 3.1 per cent, with a maximum error of 5 per cent.

To test the precision of the method, four samples containing 200 ppm of chloride were run. The results are shown in Table IV. The precision of the method is within 2 per cent.

Samples of the test solution and copies of the recommended routine procedure were sent to the following companies who kindly agreed to make check analyses: Michigan Bumper Corporation, Bethlehem Steel Company, and E. I. duPont de Nemours & Company. The results of those companies which reported along with that obtained in this laboratory are shown in Table V.

TABLE III. ACCURACY DATA

Cl^- Added micrograms	Colorimeter Readings	Average Reading	Blank Reading	Corrected Reading	Cl^- Found micrograms	Error per cent
100	295, 293, 294	294	215	79	98.7	−1.3
200	375, 374, 374	374	215	159	205	+ 5
300	450, 449, 450	450	215	235	297	− 3

TABLE IV. PRECISION DATA

Cl^- Added micrograms	Colorimeter Readings	Blank Reading	Corrected Reading	Cl^- Found micrograms	Error per cent
200	370, 375, 372	215	157	203	+1.5
200	367, 370, 365	215	152	196	−1.5
200	367, 370, 368	215	152	196	−1.5
200	370, 368, 365	215	153	197	−1.5

RECOMMENDED ROUTINE PROCEDURE

Reagents Required

1. Stock dithizone solution—0.01 per cent

   Weigh out 100 mg dithizone in a 100-ml beaker. Break up all lumps

TABLE V. RESULTS OBTAINED BY COOPERATING LABORATORIES

Laboratory	Chloride ppm
A	55
B	50
C	50

with a glass stirring rod, add 50 ml carbon tetrachloride, and stir the mixture well. When the dithizone has dissolved, filter the solution through a Whatman No. 41 filter paper to remove any insoluble material. Transfer the filtrate to a 150-ml Squibb-type separatory funnel. Add 50 ml of a 1:100 solution of ammonium hydroxide and shake for about one minute. When the liquids have separated, run the carbon tetrachloride layer into another separatory funnel containing 50 ml of the 1:100 ammonium hydroxide and shake again. Save the orange-colored aqueous layers. The second extraction should remove practically all the dithizone from the carbon tetrachloride, which will be a light green or brown at this point. Discard the carbon tetrachloride and combine the two orange-colored aqueous extracts. Wash the combined aqueous layers four times with 10-ml portions of carbon tetrachloride. This will remove any diphenyl thiocarbodiazone present.

Precipitate the purified dithizone with 2 ml concentrated HCl and shake for one minute. Finally, extract the precipitate dithizone with 25-ml portions of carbon tetrachloride until the aqueous layer has become colorless or a very light green. Run these extracts into a pyrex liter flask and dilute to one liter with carbon tetrachloride.

To protect the solution against oxidation, overlay it with a 5 per cent solution of pure hydroxylamine hydrochloride, one centimeter thick. Keep the solution in a cool dark place. It is stable for several months if kept in a refrigerator.

2. Dilute dithizone solution—0.004 per cent

   This more dilute dithizone solution is somewhat less stable than the foregoing and should be freshly prepared for each series of determinations.

   Dilute 200 ml stock dithizone solution (0.01 per cent) to 500 ml with carbon tetrachloride in a pyrex 500-ml flask. This solution will be stable for two days if covered with a 5 per cent hydroxylamine hydrochloride solution and kept in a cool, dark place. When placed in a colorimeter, the reading of the dilute dithizone solution should be approximately 230.

3. Phosphoric acid (cp grade)—85 per cent.

4. Sulfuric acid solution—5 *N*.

   Add 138.5 ml concentrated cp H_2SO_4 to about 500 ml of distilled water in a 1-l volumetric flask and dilute to 1 liter with distilled water.

5. Sulfuric acid solution—1 *N*

   Dilute 100 ml of the 5-*N* sulfuric acid solution (reagent 4) to 500 ml with distilled water.

6. Pure copper sulfate plating bath

   Dissolve 204 grams of pure $CuSO_4 \cdot 5H_2O$ crystals in 500 ml of distilled water. Add 49 grams cp concentrated H_2SO_4 and dilute the mixture to 1 liter with distilled water.

7. Standard $AgNO_3$ solution—1 g/l Ag

   Weight out 1.575 grams reagent-quality $AgNO_3$ crystals. Transfer to a 1-l volumetric pyrex flask and dissolve with distilled water. Add 3.5 ml concentrated cp H_2SO_4 and dilute the mixture to 1 liter with distilled water. This solution should be protected from light and stored in a pyrex flask.

8. Standard chloride solution—1 g/l

   Weigh out 1.6485 grams quality NaCl crystals. Transfer to a 1-l volumetric pyrex flask and dissolve with distilled water.

9. Standard chloride solution—100 micrograms/ml

   Pipette 10 ml of reagent 8 into a 100-ml volumetric flask and fill to the mark with water.

10. Sulfuric acid—concentrated, reagent quality

11. Carbon tetrachloride—pure grade

Apparatus Required

1. Volumetric flasks of 1000-ml, 500-ml, and 100-ml capacity, preferably pyrex.
2. Two 150-ml short-stemmed Squibb-type separatory funnels
3. One 50-ml burette graduated in tenths
4. Two 1-ml, one 1-ml graduated in tenths, one 5-ml and one 10-ml pipette
5. One 10-ml, one 100-ml graduate
6. Seven test tubes
7. Klett-Summerson colorimeter with a green filter No. 54 or equivalent
8. Watch with a second hand
9. Centrifuge
10. Red marking pencil

Procedure for Determination of the Blank

A. Precipitation of AgCl

1. Fill the test tubes to be used with distilled water from a 10-ml pipette. Mark the water line with a red marking pencil. Discard the water.
2. To one test tube add 5 ml pure copper bath, 1 ml 5-*N* H_2SO_4, 1 ml standard $AgNO_3$ solution (1 mg/ml, reagent 7) and fill to the mark made in step 1 with distilled water.
3. Shake the test tube and allow it to stand for 10 minutes.
4. Centrifuge for another 10 minutes.

B. Preparation of Colored Solution

5. Transfer 20 ml of the dilute (0.004 per cent) dithizone solution from a burette to a separatory funnel. This dithizone solution should read approximately 230 on the colorimeter for the best working range. Adjust the 0.004 per cent dithizone solution to read 230 before filling the burette.
6. To this add 8 ml of the 5-*N* H_2SO_4 with the 10-ml graduate.
7. Add 0.5 ml H_3PO_4 with the 1-ml pipette graduated in tenths. This will complex any iron that may be present.
8. Add a 1-ml aliquot of the solution in the test tube containing the centrifuged silver chloride (the solution in step 4).
9. Add 10 ml of distilled water.
10. Shake the mixture vigorously for exactly 10 seconds. *The time must be controlled.*
11. Quickly transfer the carbon tetrachloride layer to a second separatory funnel containing 20 ml of 1-*N* H_2SO_4 and shake vigorously for one minute.
12. Filter the washed CCl_4 layer into a 25-ml volumetric flask using No. 40 Whatman filter paper. (This will remove any suspended aqueous droplets.)
13. Fill the volumetric flask to its mark with CCl_4. Shake well.

C. Measurement of Transmittancy

14. Using a clean test tube cell, partially filled with CCl_4 as the reference liquid, adjust the colorimeter so that the galvanometer pointer is at the zero position when the dial reading is zero.
15. Pour out the CCl_4, rinse the test tube a couple of times with small portions of the filtered CCl_4 solution (from step 13), and then partially fill the test tube with this solution. Replace the test tube in the colorimeter and rotate the dial until the galvanometer pointer returns to its original position. Record the scale reading. This scale reading constitutes the blank for the method and an average of three determinations should be used.

Preparation of Calibration Curve

Readings for 100, 200, 300 micrograms of chloride are obtained in the following manner:

I. In step 2, add 5 ml pure copper bath, 1 ml 5-*N* H_2SO_4, 1 ml standard $AgNO_3$ solution (reagent 7), and also 1, 2, and 3 ml standard chloride solution (reagent 9) respectively to three test tubes, which will then contain 100, 200, 300 micrograms of chloride respectively.

II. Carry out steps 1 to 15 inclusive as in the blank determination with the modification of step 2 outlined in I.

III. The blank reading is subtracted from the readings obtained in the calibration determinations. The corrected readings are plotted against chloride concentration.

Measurement of the Unknown

The transmittancy of the unknown solution is obtained by following the procedure outlined for the determination of the blank, using the impure $CuSO_4$ bath with unknown chloride content for the pure $CuSO_4$ bath in step 2. The blank reading is subtracted from this reading and the net reading is converted to chloride concentration with the aid of the calibration curve.

Calculations

Since these solutions transmit light in accordance with Bouguer-Beer's Law in the range of 0-300 micrograms of chloride, it is not necessary to prepare a calibration curve. If the scale on the colorimeter is logarithmic, the following procedure may be used:

Run a blank and one standard solution (200 mcg Cl^-) in accordance with the procedure given above. Subtract the blank reading from the reading for the standard chloride solution.

Then run the unknown-chloride sample and correct this reading for the blank. Since the readings for both the standard and the unknown are directly proportional to the concentration of chloride, the concentration of chloride in the unknown can be easily calculated by using the formula:

$$\frac{\text{conc. of standard}}{\text{corrected std. reading}} \times \text{corrected unknown reading} = \text{concentration of unknown}$$

This method will give the answer in terms of micrograms of Cl^- per 5 ml of solution. To obtain micrograms per ml, or ppm, divide by 5.

If a calibration curve has been prepared, the corrected reading for the unknown can be compared directly to the calibration curve and the concentration of Cl^- read directly.

Example

Blank reading = 215

Reading for 200-microgram Cl^- standard = 375

Reading for unknown = 360

Corrected reading for standard = 375 − 215 = 160

Corrected reading for unknown = 360 − 215 = 145

$$\frac{200}{160} \times 145 = 181 \text{ mcg/5 ml bath}$$

$$\text{or } \frac{181}{5} = 36 \text{ ppm } Cl^-$$

Discussion of Procedure

The most critical step in this procedure is the time of extraction. The ten seconds must be timed closely or else no comparisons can be made.

The second most critical step is the dithizone solution. If at all possible, the blank, the standard Cl solutions, and the unknown should all be run on the same day because the dithizone solution will change on standing for a few days and the working range will be changed. It would require extra calculations to correct the new readings so that they compare with the standard solutions analyzed previously.

The best way to insure the ideal range of colorimetric readings is to measure the transmittancy of the dilute dithizone solution. With CCl_4 as a reference liquid and a green No. 54 filter, a transmittancy of 230 scale readings will assure a proper dithizone concentration.

Applicabilty to Other Types of Plating Baths

This method can be applied to copper cyanide baths if certain changes are made in the Measurement of the Unknown. A new step 2 is as follows: "Add 5 ml of the copper cyanide bath and 1 ml concentrated H_2SO_4. Boil the solution for 10 minutes but do not permit it to evolve SO_3 fumes. Let the solution cool, add 1 ml standard $AgNO_3$ solution (1 mg/ml Ag, reagent 7), and fill to the mark made in step 1 with distilled water". This will permit complete removal of cyanide without loss of chloride. A new step 8 is: "Add a 1-ml aliquot of the solution in the test tube containing the centrifuged silver chloride (the solution in step 4) and 1 ml of pure $CuSO_4$ bath (reagent 6)". The addition of the latter will compensate for the lower copper content of cyanide baths as compared to the acid copper plating bath.

Similar changes may be required for other types of copper plating baths.

"Stop and Go" Method

The color of pure silver dithizonate, yellow, is obtained when no chloride is present to react with the silver. The color of pure keto cupric dithizonate solution is lavender and this color is obtained when there is sufficient Cl^- present to react with the Ag^+ present. The variation in the hues of the solutions obtained with the Recommended Routine Procedure is sufficiently large to permit detection of differences of 10 ppm of Cl^- visually. The colors may be compared in test tubes.

A series of standards containing 0, 20, 40, 60, 80, and 100 ppm Cl^- may be prepared in accordance with the outlined procedure. They are stable for a few hours if the tubes are stoppered. The unknown solution is then compared with these standards.

A very rough estimate of the chloride concentration can be made on the basis of the hue of the solution without the preparation of a series of standards for comparison.

If the routine procedure is used, the following chart will serve as a rough guide:

Color of Sample	Ppm Cl^- in 5-ml sample
Orange-yellow	0
	50
Coral	100
	150
Rose	200
	250
Lavender	300

Summary

Small quantities of chloride in copper plating baths may be determined colorimetrically. The method depends upon the addition of a known quantity of silver ions and determining the excess of silver ions remaining after silver chloride has been precipitated. The excess is determined by the mixed color of silver and cupric dithizonate. Small amounts of Pb, CrO_3, Fe^{+++}, Ca, Al, Na, Ni, Si, or sugar do not interfere and no separation of these impurities is necessary. The method is simple, rapid and has an accuracy of 5 per cent.

References

[1]Berg, R., Z. anal. Chem. **69**, 342–348 (1926).
[2]Caldwell and Moyer, Ind. Eng. Chem., Anal Ed. **7**, 38 (1935).
[3]d'Ans, J. and Hofer, P., Kali **35**, 123–126 (1941).
[4]Ellms, W. J., and Hauser, S. J., J. Ind. Eng. Chem. **6**, 554 (1914).
[5]Eichler, Z. anal. Chem. **99**, 272 (1934).
[6]Grant, J., Power and Works Engr. **32**, 23–24 (1937).
[7]Hart, F. L., J. Assoc. Official Agr. Chem. **20**, 217–219 (1937).
[8]Highberger, J. H., and Moore, E. K., J. Am. Leather Chemists Assoc. **24**, 68–76 (1929).
[9]Hollander, F., and Stein, J., J. Lab. Clin. Med. **28**, 363–371 (1942).
[10]Horn, Chem. Zentr. **1927 II**, 1746.
[11]Kubierschky, Z. angew. Chem. **40**, 1511–1513 (1927).
[12]Lang, K., Biochem. Z. **290**, 289–290 (1937).
[13]Lang, R., and Messinger, J., Ber. **63B**, 1429–1431 (1930).
[14]Le Roy, D., and Laillander, M., Compt. rend. soc. biol. **97**, 557–559 (1927).
[15]Lundbak, A., Chem. Zentr. **1944 II**, 57–58.
[16]Rieman, W., Neuss, I., and Naiman, B., "Quantitative Analysis", McGraw Hill Company, New York (1942), pp. 65–69, 264–268.
[17]Seefass, E. J., and Burkhead, P., Plating **36**, 1237-1239, 1242-1244 (1949).
[18]Saifer, A., Highes, J., and Weiss, E., J. Biol. Chem. **146**, 527–535 (1942).
[19]Senton, J. A., and Kehar, N. D., Indian J. Med. Res. **18**, 199–201 (1930).
[20]Snell, F. D., and Biffen, F., "Commercial Methods of Analysis", McGraw Hill Company, New York (1944), pp. 130–131.
[21]Spiresu, E., Bul. soc. chim., Romania **8**, 115–117 (1926).
[22]Von Stein, "Organic Reagents in Inorganic Analysis", Chemical Publishing Company, New York (1942), p. 54.
[23]Wick, R. M., Nat. Bur. Stds. J. Research **7**, 913–933 (1931).

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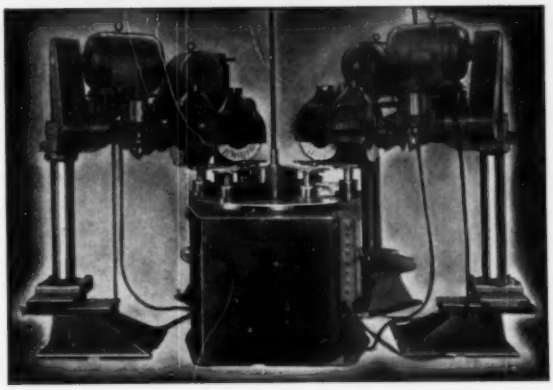

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Preparation of High-Carbon Steel

(*Continued from page 61*)

Electroplating Procedures

6. (a) Standard plating procedures can be used on high-carbon steel when the proper preparatory treatment steps described in Sections 4 and 5 have been selected and followed. The conditions of use of the plating bath should allow a minimum evolution of hydrogen at the cathode surface (highest cathode current efficiency). The use of the minimum length of time in each step of preparation and plating is recommended. The material should be handled with the minimum number of steps consistent with proper treatment.

(b) The electrodeposition on high-carbon steel of tin and cadmium is easier to accomplish than of zinc. Electrodeposition of nickel and chromium is not difficult if the recommended practice is followed. Low internal stress of the deposit is desirable.

(c) Springs and similar materials should not be plated while subject to externally applied stress.

Heat Treatment After Electroplating

7. (a) *Application.*—One purpose of the special preparatory treatments of high-carbon steel (Sections 4 and 5) is to minimize hydrogen embrittlement. In most commercial production it is necessary to bake the electroplated work for final embrittlement relief. With springs and similar materials, precautions should be observed to avoid flexing the articles before they are baked.

(b) *Procedure.*—The hydrogen may be largely removed and the physical properties of the steel substantially restored by heating, for example, for 1–5 hours at temperature in an oven maintained at a temperature of 300–500° F (150–260° C), the temperature and length of treatment depending on the severity of embrittlement, the cross-section of the article, the requirements of the steel, and the kind and thickness of the electrodeposited coatings. The baking should be done as soon as possible after electroplating, and before any supplementary chemical treatment of the plated surfaces. The best time and temperature in some cases must be established by experiment. A temperature not exceeding 400° F (205° C) is recommended for zinc- or cadmium-plated articles. A lower temperature may be required if the coating is to be given a subsequent chemical treatment.

Methods of Testing

8. (a) *Adhesion.*—No universally satisfactory nondestructive test for adhesion is known. Poor adhesion may be revealed during grinding operations.

(b) *Embrittlement.*—The test for the effectiveness of the procedures used to control embrittlement lies in the subsequent service use of the material. Applicable control tests for embrittlement may be selected by analogy to the particular service in which the high-carbon steel article being processed will be used.

Photoelectric Colorimetry

(*Continued from page 58*)

a minimum by use of the same tube, it is better to employ carefully matched, flat-sided tubes as explained before. However, flat-sided cells are usually built up by cementing flats of polished glass and the width of several cells may show a great variation. Generally, these cells are selected or held to close tolerances with a corresponding increase in cost. Square precision-bore tubing is available and may gradually replace built-up cells.

Still another source of error is introduced when turbid or colloidal solutions are measured. As was explained before, the particles in solution mechanically block the light and a false value for color absorption will be obtained. Only clear or non-colloidal solutions will obey Lambert-Beer's law.

In addition to these errors, there are errors of choice of method, errors of dilution, errors in sampling, etc. The over-all accuracy that is expected of colorimetric procedures is from 2 to 5 per cent, although the reproducibility, or precision, of an analysis may be about 1 per cent.

Still another error, more common than some of those listed above, is the choice of filters. For most purposes, the gelatine filters that are usually furnished with these instruments are sufficient. In some cases, however, two substances having nearly identical absorption peaks may be present and will interfere with each other. Some relief in this instance can be had by the use of filters having exceptionally narrow bands of transmission. There are several filters on the market that have band widths of 10 to 20 $m\mu$. Of course, the ideal solution to this problem is the use of a spectrophotometer, which is actually a colorimeter that is equipped with a continuously variable monochromatic light source in place of filters.

Summary

The development of a photoelectric colorimeter from the simple circuit consisting of a lamp, photocell, and galvanometer to a differential photocell circuit is described. A brief discussion of the use of filters and errors of colorimetry and the description of turbidimeters, nephelometers, and fluorophotometers are included. Commercially available instruments are classified.

Literature Cited

[1]Foulke, D. G., Monthly Rev. Am. Electroplaters' Soc. **32**, 367 (1945).

[2]Serfass, E. J., and Levine, W. S., ibid. See, also: A. E. S. Research Report Ser. No. 3. (1947).

[3]Mellon, M. G., "Colorimetry for Chemists", G. F. Smith Chem. Co., Columbus, Ohio (1945).

[4]Sandell, E. B., "Colorimetric Determination of Traces of Metals", Interscience Publishers, Inc., New York (1946).

[5]West, W., "Physical Methods of Organic Chemistry", edited by A. Weissberger; Chap. XVIII; Interscience Publishers, Inc., New York (1946).

Let's Get Technical.....

This month we are not going to take up any space for photographs, artwork, or snappy headlines. These are two pages of technical facts, printed on both sides so you can remove the sheet neatly and put in your file on "Rectifiers". Good thing to have around to check against various makes of rectifiers when you are in the market for D. C. power.

We're having reprints made — available on request in case you want to send a copy to the Purchasing Department.

NEW FEATURES....

The following features, which have all been thoroughly tested, and have been used on special jobs, are standard on all Selectro-Platers.

Current Overload Relay. A factory adjusted relay is connected across the ammeter shunt and associated with the main contactor so that the Selectro-Plater automatically shuts down if the load current exceeds the nameplate rating by about 5%. This is in line with recently adopted NEMA (National Electrical Manufacturers Association) standards on electroplating rectifier ratings. The relatively small quantity of metal required for rectifier elements, and consequently the low thermal capacity, makes intermittent "overload" ratings impractical if not downright dangerous. The cost of rectifiers is such that, if more capacity is needed, it is good sense and good economics to specify a larger unit in the first place — or add a second unit in parallel.

The current overload relay provides reliable protection against current overload.

"Single-Phase Protection". Sometimes one of the three phases supplying a rectifier will disappear, due perhaps to a blown fuse in the local cutout box or back on your main switchboard. When this happens the rectifier may stop or it may not, depending upon which particular phase is out. If it does not shut down, but continues to operate, it does so on only some of the transformer windings and some of the rectifier stacks. This is known as "single-phasing" and is analogous to a six cylinder motor firing on only four cylinders. If the operator does not realize what has happened, and tries to squeeze out the full rated capacity, he may cause permanent and expensive damage.

With the new "anti-single-phase" circuit, your Selectro-Plater will shut down automatically if *any* one of the three phases disappears, and cannot be restarted until the trouble has been corrected. It may never happen in your plant, but it's nice to know you have positive protection.

Dual Input. The standard input arrangement on all Selectro-Platers will allow you to connect up for 230 or 460 cycle three phase supply without elaborate rewiring. Special input terminal board, clearly marked, shows how to connect for either type of input. The 230 volt connection has sufficient margin for operation from 208. If you have an unusual A.C. supply — for instance 180, 260, 550 or some other odd voltage — you can specify that your Selectro-Plater be built for this *single* voltage at no additional cost. Also, 50 cycles instead of 60, at no extra cost.

Continuous Fan Operation. Generally, when a rectifier is shut off, while the tank is being loaded or unloaded, the fan also stops. In the Selectro-Plater the fan keeps running, (drawing negligible current) rapidly cooling off the rectifier stacks, bringing them down to room temperature ready for a fresh start. During those extra-hot days when you want to operate at full capacity, continuous fan operation is desirable. Note: the fan stops when the fuse box switch is pulled at the end of the shift.

Fan Fuses. In all Selectro-Platers of the fan-cooled type we incorporate a separate fuse block protecting the fan motor and pushbutton control circuit—an arrangement preferred by inspectors in some localities. Incidentally, the fan motor circuit is so arranged that the Selectro-Plater cannot be turned on unless voltage is present across the fan motor.

Improved Switches. During the war there were occasional reports of voltage control switches damaged by extra powerful operators. Some of the torque-transmitting parts were made of ceramic, a good insulator but not very high in tensile strength. These parts are now made of tough laminated plastic and field observations show that switch breakages from this cause have been eliminated.

CLIP FOR YOUR FILE

Let's Get Technical... (cont'd)

PLUS — ORIGINAL FEATURES

Following is a brief recap of standard features with which you may already be familiar. Like to remind you that most of these were originally developed by Green Electric and have been standard in Selectro-Platers for nearly ten years.

Multiple Coat Finish. Our selenium stacks have a multiple-coat baked finish, corrosion and moisture resistant, identical with that specified for Navy rectifiers.

Downdraft Cooling. Air intake enters top of cabinet — simplifies attachment of air intake duct required for some locations.

Skyscraper Construction. Space-saving cabinet, tall and narrow, mounted on caster wheels for easy installation.

49 Step Voltage Control. 49 steps, zero to maximum, provide fine control for nearly any metal finishing process. Optional, at no additional cost, 49 steps over narrower range. For example, "4 to 8 volts" instead of "zero to 8 volts", gives still finer control over the narrower range.

Large Meters. Output voltmeter and matching ammeter, 4½" rectangular type for good visibility. Factory checked for accuracy during final full-load test.

Full-Load Test. Every Selectro-Plater is individually tested at full load rating for efficiency, temperature rise, power consumption and is completely checked before shipment.

Monitor System. Red lamp and buzzer warning to operator if rectifier stacks become too warm for any reason.

Fan Thermostat. Thermostat mounted between rectifier stacks and downdraft fan automatically shuts off Selectro-Plater if air flow is blocked for any reason.

Twin Output Terminals. DC output terminals on both sides of cabinet so tank busbars may be connected to either side. Useful also for parallel or series connections of Selectro-Platers.

Indicator Lamps. Green pilot lamp, visible across shop shows when Selectro-Plater is operating. Red lamp (see "Monitor") warns of abnormal conditions.

Instruction Book. Detailed, individually compiled book, covers installation, operation, circuit schematic, and simple maintenance routines.

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QUESTION BOX

——readers' questions of general interest——

Q. 67. What is Elkington Plate?
A. According to Cassidy's Ltd., Toronto, Canada, the sole distributor of Elkington Plate in Canada, the composition of the silver is no different than that of the usual silverplate. However, each piece is hand burnished and for that reason seems to keep its bright finish longer.—B. EGEBERG.

Q. 68. How can I clean soft soldered copper and brass parts that have been bright dipped with consequent black discoloration of the solder?
A. Dip in a mixture of fluoboric acid and hydrogen peroxide.—C. STRUYK.

Q. 69. Does infrequent use of a plating bath have any bearing on pitting?
A. Air dissolved in the bath during idle periods may be responsible for pitting. Preheat the bath to a temperature higher than that used in normal operation and then permit the temperature to drop to normal; this will expel air causing pitting.—M. B. DIGGIN.

Q. 70. What is the cause and cure for discolored chromium plate in a solution with a sulfate ratio of 80? Bath temperature, chromic acid concentration and contacts are all under control.
A. Make a Hull Cell test to determine the bright-plate range. If because of presence of foreign anions the effective "catalyst" ratio is substantially lower than the sulfate ratio obtained by analysis, remove some of the sulfate by the usual barium carbonate precipitation.—E. R. BOWERMAN.

Q. 71. What kind of nickel plating solution should be used under a final rhodium plate on Britannia metal that has been finished partly bright and partly satin? There should be no additional finishing of the nickel.
A. Brightness seems to be desired without levelling. For that purpose one may use an old-fashioned bright nickel bath containing gums.—M. B. DIGGIN.

Q. 72. We are interested in the properties of electrodeposited metals at extremely low temperatures (−125° F). A literature search has not produced any specific information. Any information on the subject that you can furnish us will be appreciated.
A. Inquiries to a number of plating authorities have produced negative results. Can any reader help out?
—EDITOR.

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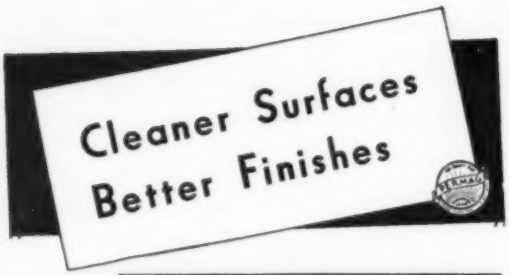

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Book Review

DR. HAROLD J. READ

Associate Professor of Metallurgy, Pennsylvania State College

INDENTATION HARDNESS TESTING by Vincent E. Lysaght, 1949, xii + 288 pages. Reinhold Publishing Corporation, 330 W. 42nd Street, New York 18, N. Y. Price, $5.50.

Anyone who has been searching for a concise, accurate and easily readable book on the practical aspects of hardness testing need look no further than Mr. Lysaght's new book. In it he has brought together all the information that is likely to be needed for the intelligent selection of the proper test to be used and the equipment for its execution. His extensive experience in the field has enabled him to write with authority, and his writing skill permits him to present his knowledge in a very lucid fashion.

The amount of theory in the book is limited, but sufficient to acquaint the reader with the basic problems involved in hardness testing and to account for some of the difficulties which are encountered in the interpretation of the test results. The discussion of Meyers' analysis is, perhaps, the most abstract matter in the volume, and it is done in an uncommonly intelligible manner.

All of the machines which are commercially available are described in some detail as to their principles of operation and mechanical construction. What is more important, the author has indicated the particular field of usefulness of each machine in the course of discussing its particular advantages and disadvantages.

The latter part of the book contains a number of interesting chapters on such subjects as hardness conversion relationships, tests on cylindrical surfaces, hot hardness testing, the applicability of hardness tests, and the use of indentation methods on nonmetallic materials.

A chapter on the microhardness testing of metals will be of particular interest to the metal finisher. The author not only describes the methods which are available, but also gives, largely by means of examples, an excellent idea of what can be done with each method. He does not neglect the pitfalls which may be encountered or the precautions which must be exercised in order to obtain reliable results.

There are 135 excellent photographs, drawings and graphs in addition to a number of tables which aptly illustrate the author's written discussion. Furthermore there is a large appendix which provides much useful data.

Article Abstracts

For copies of original articles, turn to your Public Library for photostats or addresses of the publications in question

Evaluation of Paint Films. C. J. Rolle and T. L. Dietrich. Anal. Chem. **21,** 996–997 (August, 1949).
A method is presented for resolving the stripping-force measurements of organic coatings on metal surfaces into their basic factors of plasticity and adhesion. The application of this method should make the adherometer a useful research tool in the evaluation and formulation of organic finishes.

Hardness of Hard Chromium Plate and Current Efficiency as Functions of Conditions of Deposition. W. Eilender, H. Arend and E. Schmidtmann. Metalloberflache **2,** No. 3, 49–52 (1948); Henry Brutcher, Altadena, Calif., Tech. Transl. No. 2303.
A study of influence of deposition conditions on brightness, hardness, and current efficiency in sulfate and sulfate-fluosilicate types of bath.

Vaporization Cooling of Large Electrical Machines. Th. De Koning. J. Frank. Inst. **248,** 49–68 July, 1949).
This article describes a method of cooling as revolutionary as hydrogen cooling was in the twenties. A much wider applicability, considerable savings, and other advantages are expected of it. The principles of vaporization cooling are so different from those customary for other media (air, hydrogen, and fluid) that for a proper evaluation one must make oneself free from any preconceptions. The fundamentals, the far-reaching influence upon the design of machines and machine-sets, -stators and -rotors, the methods of supplying the cooling means, the conditioning of the machines, and finally the influence of the cooling means upon the insulation and upon other machine parts (corrosion) are discussed.

Priming Paints for Light Alloys. J. G. Rigg and E. W. Skerrey. Paint Manuf. **19,** 77–83 (1949).
Preliminary results of a study of the protection afforded to aluminum and magnesium alloys by various paint primers in rural, industrial, and marine atmospheres show that iron oxide primers provide the most protection. Exposure conditions and examination of specimens are discussed, and tables show physical tests of priming paints and analyses of metals included in tests. A summary of results for accelerated test after 30 weeks' exposure and for industrial specimens after 25 weeks' exposure are given.

Automatic Metal Spraying. Anon. Met. Ind. (London) **74,** 206–207 (March 18, 1949).
The results achieved in the protection of wire by

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2— 800 Ampere, 50 V. Gen. Elec.
1— 400 Ampere, 50 V. Gen. Elec.
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sprayed aluminum have indicated the possibility of application to constructional steelwork. A plant has been designed and built by Metallisation, Ltd. Mill scale and rust are removed by an airless gritblasting machine. As the steel leaves the machine, the shot on its surface falls through a number of hoppers onto a long rubber belt on which it is returned to the machine. After being cleaned, the steelwork is pulled through the automatic spraying machine where metal-spraying pistols apply a coating of aluminum with a minimum thickness of 0.004 inch.

The Role of Natural Convection in Electrolytic Processes. Carl Wagner. J. Electrochem. Soc. **95**, 161–173 (April, 1949).
It is shown theoretically and experimentally that a well defined convective flow, due to the generally lower density in the boundary layer and the resulting buoyancy, exists at a vertical cathode. Interplay between diffusion and convective flow determines the limiting current density which occurs if such a voltage is applied that the concentration of one of the reactants at the electrode drops to zero. Data are tabulated. 11 ref.

Black Nickel Plating: Solutions, Defects, and Remedies. Electroplating and Metal Finishing **2**, 249–252 (April, 1949).
Defects, probable causes, and suggested remedies are tabulated. Recommended solution recipes are given.

The Production of Hard-Chromium Plated Bearing Surfaces with Good Sliding Properties. Karl Gebauer, Metalloberflache **2**, 161–165 (August, 1948).
Discusses the prob'em of lubricating chromium-plated sliding surfaces and methods of producing "oil pockets" as a means of counteracting the poor wettability of chromium with oil. Diagrams and photomicrographs show structures of surface layers and bond to the base metal.

Relationships Between Conditions of Formation and Shape of Electrodeposited Metal Crystals.

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I. The Formation of Block Structures in Electrodeposited Metal Crystals. II. The Role of Inhibitors Having a Moderate Effect. Hellmut Fischer. Z. Metallkunde **39**, 161–170, 204–210 (June and July, 1948).
In Part I a theory of crystal growth is developed, showing effects of a variety of factors. Dimensions of growth layers are calculated for silver crystals. Results indicate that the surface is never wholly passivated but always retains some residual activity. Part II presents results of a fundamental study of the effects of mild inhibitors. Data are tabulated, graphed, and discussed.

Pickling Experiments with Sheet Zinc and Zinc-plated but Partly Rusted Sheet Iron. W. Machu. Arch. Metallkunde **2**, 62–69 (February, 1948).
The solubility of zinc of 99.9 and 99.4 per cent purity in inhibitor-containing dilute sulfuric acid and in other acids was investigated, also the behavior of zinc in cathodic pickling solutions. The effects of acid mixtures and of organic acids are included. Data are graphed and tabulated.

Hydrogen Overpotential and the Partial Inhibition of the Corrosion of Iron. J. O'M. Bockris and B. E. Conway. J. Phys. Coll. Chem. **53**, 527–539 (April, 1949).
Two main mechanisms of corrosion inhibition during pickling have been suggested. Describes experimental work done in order to determine the true mechanism involved. Results, which are tabulated and charted, indicate that the inhibition is by means of a direct effect on the hydrogen activation overpotential and not by mechanical protection through an adsorbed film. 23 ref.

The Rate of Oxidation of Nickel. Oswald Kubaschewski and Ortrud v. Goldbeck. Z. Metallkunde **39**, 158–160 (May, 1948).
The author compares his results with those obtained by others. An effect of the purity of the nickel on its resistance to oxidation is indicated, and an equa-

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tion shows the probable effect of temperature on oxidation rate. Data are graphed and tabulated.

The Protective Value of Pickling Inhibitors and Their Evaluation. I. H. Fischer. Arch. Metallkunde **2,** 1–9 (January, 1948).

Presents a comprehensive report on laboratory work on the chemical removal of rust and scale from iron and steel. Results are compared with those of tests made on an industrial scale. Data are graphed and tabulated.

The Chemical Production of a Heavier Protective Film of Magnesium Fluoride on Magnesium Alloys. M. Staesche. Arch. Metallkunde **2,** 99–102 (March, 1948).

According to the process described, a primary film of magnesium hydroxide is applied to the magnesium by means of caustic soda and converted, by boiling in fluoride solutions, into magnesium fluoride. Thirty-day tests in oxygen-containing sea water proved that the samples thus treated were highly resistant to corrosion. Results are graphically and photographically illustrated.

Phosphating as a Topochemical Reaction. A. Wustefeld. Arch. Metallkunde **3,** 43–45 (January, 1949).

Discusses the effect of accelerators, the properties of the phosphate film (surface structure, color, plasticity), its effect on the hardenability of lacquer, and its adsorbing power for lubricants. Includes table, graph, and photomicrographs.

Physical Properties of Iron Deposited from Chloride Baths. I. Larson, R. W. Moulton and G. L. Putnam. J. Electrochem. Soc. **95,** 86C–92C (April, 1949).

Determination was made of the effects of *p*H, temperature, current density, and ferric-iron concentration on the above. Data are plotted. 15 ref.

A Note on the Possible Role of the Solid Surface in Electroless Plating. E. E. Glenn, Jr., E. L. Cook, and Norman Hackerman. J. Electrochem. Soc. **95,** 110C–112C (May, 1949).

Describes some experiences with electroless plating of nickel on both glass and metal surfaces. Effects of seeding and rough surfaces on initiation of deposition were determined. Theoretical conclusions are summarized.

A Method of Centrifuging Alkali Cleaners in Finishing Plants. Philip P. Sharples. Finish **6,** 23–24, 68, 70 (May, 1949).

Describes use of supercentrifuge to remove miscellaneous contaminants from metal-cleaning baths. Procedure resulted in load increase of 20 per cent and large reduction in cleaner consumption.

Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,480, 771, August 30, 1949—Process for the Electrolytic Recovery of Nickel—L. S. Renzoni, assignor to The International Nickel Company.

I have discovered a novel liberator cell and a method employing the novel cell with insoluble anodes and a chloride-ion-containing electrolyte whereby the electrolytic system can be operated in balance, with respect to nickel, during electrolysis and wherein nickel is recovered by electrodeposition at a cathode without liberation of chlorine at an insoluble anode.

CLAIM 1. A process for electrolytic recovery of nickel from aqueous nickel-containing solution which comprises introducing into an acid-resistant, diaphragmous-walled cathode compartment containing a cathode, a solution consisting essentially of water with hydrogen ions to provide a *p*H of about 4 to 5 and with about 56 to 57 grams per liter of nickel, about 27 to 30 grams per liter of chloride ions, about 71 to 120 grams per liter of boric acid, said solution being at a temperature between about 100° F and 120° F; introducing into an adhacent, acid-resistant diaphragmous-walled anode compartment containing an insoluble lead anode having a content of about 6 per cent antimony and spaced apart from said cathode compartment by an intervening compartment having common diaphragmous walls with said anode compartment and said cathode compartment, a solution consisting essentially of water with about 10 grams per liter of sulfuric acid but substantially devoid of chloride ions, said solution being at a temperature between about 100° F and 140° F; maintaining the level of each of said solutions in the respective compartments sufficiently high to cause each of said solutions to flow through the respective diaphragmous wall to form mixed solutions in said intervening compartment located between and connecting said anode compartment and said cathode compartment; withdrawing the mixed solutions from said intervening compartment at a level below the depth of both the anode compartment and the cathode compartment at a rate sufficient to maintain the level of the mixed solutions in said intervening compartment below the respective levels of the solutions in said anode compartment and said cathode compartment and to maintain the respective flows of said solutions into the intervening compartment; and passing electric current through the solutions between said anode and said cathode at an anode current density between about 20 and 50 amperes per square foot to deposit nickel on the

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cathode whereby nickel is electrolytically recovered from aqueous solutions containing nickel and chloride ions while substantially preventing evolution of chlorine gas at the insoluble anode.

9 claims, 11 figures.

References cited: U. S. Patents 679,985; 805,969; 1,003,092; 1,239,012; 1,375,631; 1,389,829; 2,394,874. British Patent 9,563.

No. 2,485,563, October 25, 1949—Zinc Electroplating Compositions and Method for the Electrodeposition of Zinc.—A. E. Chester and F. F. Reisinger, assignors to Poor and Company, Chicago, Ill.

. . . new and improved results in electrodeposition of zinc are obtained by incorporating into cyanide-zinc plating baths compositions or concentrates containing zinc aldonate, preferably zinc gluconate, and preferably also containing an alkali-soluble protein derived from a vegetable-seed meal, such as for example soya-bean meal.

A further feature of the invention in its preferred aspects is the incorporation into compositions or concentrates of the type described for addition to electroplating baths ammonium alginate and/or naphthylamine salt of an aldonic acid, preferably the alpha-naphthylamine salt of gluconic acid.

Zinc aldonate alone when incorporated into a cyanide-zinc plating bath has the effect of increasing the cathode efficiency and hence the speed of deposition and to some extent decreasing or lessening the burning tendency. The alkali-soluble seed meal may also be used alone, but has the disadvantage of a tendency to coagulate and is preferably used in combination with zinc aldonate. The presence of the seed-meal protein in the bath increases brightness, but its biggest effect is to widen the range of allowable current density. Both the naphthylamine salt of the aldonic acid and the ammonium alginate contribute to an improvement n the color or snap of electrodeposited zinc.

A concentrate or composition containing all four of the aforementioned ingredients is clear and stable against precipitation on standing when added to a cyanide-zinc plating bath in relatively small amounts. (Preparation of addition agents described in detail.)

CLAIM 11. A zinc plating composition comprising a solution containing sufficient amounts of dissolved gluconate, an alkali-soluble soya-bean protein, and the alpha-naphthylamine salt of gluconic acid to enhance brightness and speed of deposition.

CLAIM 12. . . . containing . . . ammonium alginate . . .

13 claims.

References cited: U. S. Patents 644,658; 1,536,859; 1,564,414; 1,692,240; 1,894,669. German Patent 601,036.

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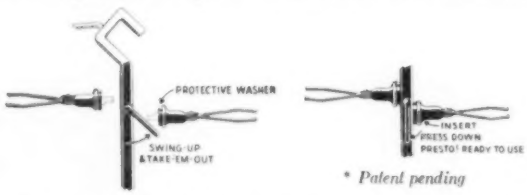

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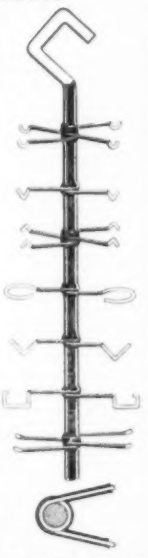

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No. 2,485,565, October 25, 1949—Cadmium Plating—A. E. Chester and F. F. Reisinger, assignors to Poor & Company, Chicago, Ill.

. . . greatly improved results in cadmium plating from cyanide-cadmium baths are obtained by electrodepositing the cadmium from an electrolyte containing an amine salt of an aldonic acid and/or a nickel salt of an aldonic acid. The term "amine salt of aldonic acid" is employed herein to describe reaction products of amines with aldonic acid. In the practice of the invention it is preferable to employ amine salts derived from relatively high-molecular-weight amines. The preferred type of amine is alpha-naphthylamine gluconate. A preferred nickel salt for the purpose of the invention is nickel gluconate. It will be understood, however, that other types of amine salts may be employed and that other nickel aldonates may be used.

CLAIM 19. In the electrodeposition of cadmium, the tep comprising electrodepositing cadmium from an aqueous cyanide-cadmium plating bath having dissolved therein an aromatic amine gluconate and nickel gluconate.

20 claims.

References cited: U. S. Patents 1,536,858; 1,564,413; 1,681,509; 1,818,179; 2,085,750; 2,107,806; 2,406,072. Modern Electroplating (1942), p. 104.

No. 2,476,286, July 19, 1949—Marine Electrocleaning and Electropickling Apparatus—G. C. Cox.

This invention relates to. . .electrolytically cleaning or pickling the metal hull of a ship or other metallic structure which is submerged in sea or seaport water.

CLAIM 1. Apparatus for electrolytically cleaning the surface of metal parts which are submerged in an electrolyte, comprising a frame, a plurality of elongated electrodes mounted in said frame, a plurality of elongated, highly conductive elements mounted in said frame between said electrodes and the surface to be cleaned and electrically insulated from and spaced from said electrodes, said highly conductive elements being in a plane parallel to said electrodes, electric-current shields partially surrounding said electrodes and highly conductive members, said shields being situated to collect material removed from the surface being cleaned to direct such material away from the electrodes and highly conductive elements, and means to cause an electric current to flow between said electrodes and the surface to be cleaned.

4 figures, 4 claims.

References cited: U. S. Patents 496,707; 820,105; 981,922; 1,154,092; 1,794,973; 1,850,426; 2,200,469; 2,232,019; 2,319,624. British Patent 26,504. "Electroplating with Chromium, Copper and Nickel", by Freeman and Hoppe (1930), p. 128. "The Distribution of Electrodeposits", Met. Ind. 267 (April 28, 1944).

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M. E. Baker Co., Cambridge, Mass.
Davies Supply & Mfg. Co., St. Louis, Mo.
Empire Electro Plating Supplies Corp., New York, N. Y.
Seiler Chemical, Baltimore, Md.
Pesco Products, New York, N. Y.
L. H. Butcher Co., Los Angeles, Cal.
Chemical Sales & Service Co., Worcester, Mass.
Electroplaters' Supply Co., Pittsburgh, Pa.
W. D. MacDermid Chemical Co., Bristol, Conn.
R. W. Renton Co., Cleveland, Ohio

CHEMCLEAN BREVITIES

Facts Without Frills

BURNISH-ALL

One proven burnishing compound that is good for all metals.

Fast working.

Safe and simple to use.

Not critical.

Suitable for self rolling or with burnishing medium in all types of equipment.

High lustre, at low first cost and low operating cost.

That's the Story

Price in 350-lb. barrels, 18c lb., f.o.b. plant.

Send for a trial lot—

40 lbs. at 25c lb., f.o.b. plant.

CHEMCLEAN PRODUCTS CORP.

Manufacturers of Industrial Cleaners, Strippers and Chemical Specialties

DEPT. P-JA-3
64 SIXTH AVE.
NEW YORK 13, N. Y.

Equipment and Supplies

E—393. Blast Cleaning for Precision Parts—Liquid Honing, developed by the Vapor Blast Manufacturing Company, 3025 W. Atkinson Avenue, Milwaukee 9, Wis., is said to work with equal effectiveness on delicate spark plugs as on large aluminum surfaces of aircraft. Engines, armament parts, plant machinery and tools can all be cleaned by Liquid Honing.

The process uses microscopic particles of silica and novaculite suspended in liquid and jettisoned by high-pressure air to provide the blasting effect. By varying the size of the abrasive particles, gun distances, and blasting time it is possible to process the most delicate, precision parts. For further information, use Reader Service Card.

E—394. Di-Phase Cleaner—Chemclean Products Corporation, 64 Sixth Avenue, New York, N. Y., announces the development of Chemclean No. 133, a non-corroding "di-phase" precleaner for all metals. It is said to remove buffing and drawing compounds, oils, greases, etc., to be safe to work with and simple and inexpensive to use, and to eliminate all hand operations.

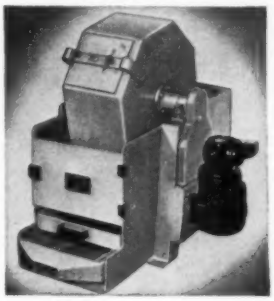
To make up the bath, pour 1 volume of Di-Phase No. 133 on 3 volumes water (the No. 133 floats on top). Objects can be in either phase, No. 133 or water. The parts are allowed to remain 2 to 5 minutes in the solution, removed, and without rinsing put through either a mild-alkali soak cleaner or directly into an electrocleaner. For further information, use Reader Service Card.

E—397. Metal Cleaning Compound—Quaker Formula 100, synergized synthetic cleaner, developed and sold by Quaker Chemical Products Corporation, Conshohocken, Pa., is said to be successful in the removal of mineral-oil type soils.

This powder-type product is used at concentrations of 2-3 oz/gal at 180° F to boiling, and is said to prepare metal surfaces for bonderizing, electroplating, painting, and other critical operations with immersion times of less than two minutes in the cleaning cycle. It can be applied to the cleaning of steel, brass, die casting, and aluminum, it is stated. For further information, use Reader Service Card.

E—396. Easily Cleaned Filter—The design of a horizontal-plate filter announced by the Sparkler Manufacturing Company, Mundelein, Ill., permits quick, easy cleaning of the filter plates without removal from the filter. This unit is intended for use where a large volume of filtrate requires frequent cleaning of filter plates during the production run. A side panel that can be opened to expose all plates and a specially designed horizontal plate with a flush top surface permits the filter cake to be washed off quickly and completely. Any type of cloth or synthetic filter media may be used, as well as wire cloth if desired. At the end of the filtration cycle, all the plates can be removed at one time through the top. The unit is available in a wide range of materials and linings to handle all types of liquids, with capacities ranging from 60 to 60,000 gph. For further information, use Reader Service Card.

E—395. Small Lot Variable Speed Tumbling Barrels—New ease, speed and convenience in tumbling small lots of stampings, die castings and similar



pieces are claimed for a variable-speed small-lot deburring barrel announced by Belke Manufacturing Company, 941-955 N. Cicero Avenue, Chicago 51, Ill. It is also said to be ideal for test runs to determine correct rotating speed, the kind and size of media or abrasive, the best load size, and other factors essential to efficient finishing.

Mounted on a bench or small stand, the barrel is rotated by an enclosed variable-speed drive which permits easy adjustment to any speed between 13 and 39 rpm. Two sliding trays, the top one of which is perforated, afford quick separation of the work.

The barrels are available in two sizes. The total capacity of Model 2 is 0.4 cubic feet and of Model 3 is 2.0 cubic feet. For further information, use Reader Service Card.

E—398. Variable Speed Deburring and Finishing Barrel—A new deburring and finishing barrel, Model No. DB-200, has been announced by the Almco Division, Queen Stove Works, Inc. The manufacturer reports that this equipment has been thoroughly tested on a wide variety of work.

Barrel speed is variable from 6 to 30 rpm, and maximum safety is claimed because of a rollaway perforated hood which permits positioning of the barrel with the hood down. A positive magnetic break allows inching of the barrel into position.

There are no protruding parts or door handles. Both forward and reversing safety switches are provided. For further information, use Reader Service Card.

E—399. Self-Contained Small Dust Collector—Model 331D Dustkop dust collector is a complete midget dust-collecting "system" intended for laboratory, small-wheel grinding, buffing, polishing, jewelers' work, etc. Rated in excess of 300 cfm it is especially designed for use in very limited space (12 x 14 x 18 inch height).

The Model 331D is supplied by Aget-Detroit Company, Ann Arbor, Mich., complete with bench-top hood, sheet-metal pipe and elbows so that installation can be completed in a very short time. For further information, use Reader Service Card.

E—400. Dry Plating Process—A process of metal plating by means of a gaseous medium, developed by the Commonwealth Engineering Company, involves the thermal decomposition of metal carbonyls in an inert atmosphere of carbon dioxide.

Objects to be plated are radiant-heated in a plating chamber supplied by a metal-carbonyl generator. The closed system recycles the plating gases for economy of operation. An integral metal coating is quickly obtained at a temperature of approximately 400° F, and the dry process is applicable to any material which will withstand this temperature range. Rate of uniform deposition is said to be far higher than that of conventional electroplating, and irregular surfaces, complex shapes, and articles with internal areas are readily handled.

The process is ideally suited to the continuous plating of strip moving at fairly high speeds. A web of fine, hard paper moving at a substantial speed can be readily coated by the gas-plating method, opening up new possibilities for the production of foil laminates, can-making materials, and condenser papers. Metal strip may likewise be gas plated at high speed.

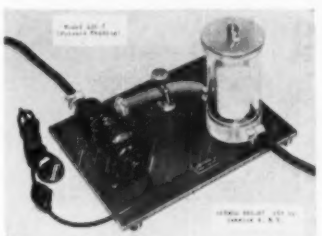
Carbonyls of a number of metals, including nickel, iron, chromium, tungsten, and molybdenum, may be used in the process. Surface preparation for gas plating is the same as for electrolytic plating. Control of the process is relatively simple, however, without the complicating factors of complex baths, delicate solution balances, and intricate electrodes currently required in some wet plating. For further information, use Reader Service Card.

E—401. Chemical Resisting General Maintenance Paint—A new paint with chemical resistance said to be far higher than that of ordinary general-maintenance paints has recently been placed on the market by the Organic Coatings Division of United Chromium, Incorporated, 51 E. 42nd Street, New York 17, N. Y. The new paint, known as Ucilon 1701, is based on chlorinated rubber. It is claimed of real advantage in contact with acid and alkali fumes, moisture, vapors, grease and oils and is recommended as a coating for floors, walls, ceilings, exteriors of storage tanks, structural steel and exteriors of certain process equipment, and machinery in industrial atmospheres.

It can be applied over old paint or other surfaces without priming and without sandblasting or other surface treatment. Loose rust and scale, however, should be removed. Only one or two coats are required. Coverage is between 350 and 500 sq.ft. per gallon, depending on the smoothness and porosity of the surface. It is available in a full range of colors suitable for carrying out functional color schemes. For further information, use Reader Service Card.

E—402. Burnishing Compound—Chemclean Products Corporation, 64 Sixth Avenue, New York, announces the development of a new burnishing compound called Burnish-All for use on a variety of metals. It is said to bring up a more brilliant luster on most metals and their alloys in less time than is usually required by other materials and to be equally effective when used with burnishing medium as in self-rolling operations. For further information, use Reader Service Card.

E—403. "Pint-Sized" Filter Pump Unit—Sethco, 105-107 150th Street, Jamaica 4, N. Y., announces a new addition to the Sethco filter family, Model LSU-5 for all plating solutions. This pint-sized unit, the smallest industrial filter ever built, comes complete with motor,



pump and filter mounted on a laminated bakelite panel, and is furnished with hose which is both acid and alkaline resistant.

Features are low initial cost and economical operation; back-washing; AC-DC motor; stainless (type 316) pump; heat-resistant Lucite filter cylinder; complete drainage; design for continuous or intermittent filtration at a rate of 50 gal/hr; exceptional fine degree of filtration. For further information, use Reader Service Card.

E—404. Filters—Production of a series of new, low-cost filter units, especially

AVAILABLE FOR IMMEDIATE SHIPMENT ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—15,000/7500 AMPERE, 6/12 VOLT **COLUMBIA ELECTRIC CO.**, with Separate M. G. Exciter.

1—10,000/5000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**, Separately Excited, Synchronous Motor, Excellent Condition.

1—5000/2500 AMPERE, 6/12 VOLT, **EAGER ELECTRIC CO.**, Separately Excited, Excellent Condition.

1—5000/2500 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS," Separately Excited.

1—4000/2000 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.**, Compound wound, Separately Excited.

1—3000/1500 AMPERE, 6/12 VOLT, **CHANDEYSSON ELECTRIC CO.**, Synchronous Motor, Separately Excited, Exciter-in-Head.

1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS CO.**, Synchronous Motor, Separately Excited.

1—2000/1000 AMPERE, 12/24 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**, Excellent Condition, Separately Excited.

1—1500/750 AMPERE, 6/12 VOLT, **HANSON-MUNNING CO.**, Shunt Wound, Separately Excited.

2—1000/500 AMPERE, 6/12 VOLT, **CHARLES J. BOGUE ELECTRIC CO.**, Separately Excited, Interpole Design, Exciter-in-Head.

1—1500 AMPERE, 40 VOLT, **HANSON-VAN WINKLE-MUNNING** Anodizing Synchronous M. G. Set, Automatic Controls, Exciter-in-Head.

1—1000 AMPERE, 40 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Anodizing Synchronous M. G. Set, Exciter-in-Head.

1—1000 AMPERE, 25 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**, Separately Excited, Anodizing Unit.

OTHER SIZES OF ELECTROPLATING AND ANODIZING MOTOR GENERATOR SETS IN STOCK.

4—**G. E.** COPPER OXIDE RECTIFIER, 500 AMPERES, 6 VOLTS, for operation on 220/3/60.

10—400 AMPERE, 6 VOLT, **UDYLITE-MALLORY** RECTIFIERS, with built-in Regulators.

1—2000 AMPERE 6 VOLT, **GENERAL ELECTRIC CO.** COPPER OXIDE RECTIFIER for 220 volt, 3 phase 60 cycle input.

2—1440/270 AMPERE 6/12 VOLT, **UDYLITE-MALLORY** RECTIFIERS, for 220/440 volt, 3 phase, 60 cycle input.

M. E. BAKER CO.

25 WHEELER STREET
CAMBRIDGE, MASS.

Equipment and Supplies

adapted to the filtering of light solutions, has just been announced by Titeflex, Inc., 500 Frelinghuysen Avenue, Newark, N. J. Designated as the SEN series, the new units contain all of the features of regular Titeflex filters but are produced at minimum cost. They require no bags, pads, etc., filtering being accomplished by filter-aid supported by rigid membranes of wire-mesh or porous stone. The new units are cleaned by a backwash system, eliminating labor. Available in plain steel, rubber-lined steel and Type 316 stainless, these filters are said to operate efficiently with both cyanide and acid solutions. Capacities are 400, 560, 1,020, and 2,280 gph on open pumping. Standard equipment includes filter chamber, pump, motor, motor starter and all valves and fittings, assembled on a portable platform. Precoat tanks can also be supplied at slight extra cost. For further information, use Reader Service Card.

E—405. Stop-off Wax—Michigan Chrome and Chemical Company, Detroit 7, Mich., announces Microwax, a new single-material wax for selective stop-off said to be especially suited for masking on complicated parts and sharp edges. It is an odorless wax that will not crack and has a remarkable degree of adhesion even to flat surfaces, requires no prime coat on material before its application, and hardens immediately after the part has been dipped thereby minimizing preparation time and speeding up production on parts before plating, according to the manufacturer. For further information, use Reader Service Card.

E—406. Roller Type Emergency Fire Blanket—Industrial Products Company, 2824 N. 4th Street, Philadelphia 33, Pa., announces a new roller-type fire blanket for use in chemical laboratories, paint-

spray lacquer rooms, or other locations where the hazard of clothing catching fire is present. One arm is put through the blanket loop and a turn of the body is all that is necessary. End of blanket automatically detaches from roller. The blanket is treated to make it fire retarding and mothproof. For further information, use Reader Service Card.

E—407. Rinsing Aid—R. O. Hull & Company, Inc., 1279 W. 3rd Street, Cleveland, Ohio, announces a new product known as Rins-Aid for addition to a static rinse tank. It is said to form a water-repellent film on freshly plated work and hence to leave the surface of the work virtually dry. A concentrated product, it is added to the water rinse in the amount of about 10 oz/100 gal. Although it may be used in the final rinse, it is preferred to make the addition to the rinse tank just before the last dip.

Advantages of the Rins-Aid dip are said to be virtually complete freedom from water staining of chromium, nickel, cadmium or zinc; improvement in uniformity of appearance of the surface; greater ease of drying; and use of a lower temperature than usual in the final hot-water rinse. For further information, use Reader Service Card.

E—408. Cotton Potash Brush—A new and improved design in cotton potash brushes has been developed by the Hanson-Van Winkle-Munning Company, Matawan, N. J. The outstanding feature is that the cotton wicking is anchored by a twisted stainless-steel wire, not only in a straight-handle brush but also in a curved handle brush. Additional features are said to be 20 per cent more cotton than standard and the use of a generous amount of cotton wicking around the end of the block where it is needed the most. For further information, use Reader Service Card.

TODAY'S BEST BUY

for Setting Up POLISHING WHEELS AND BELTS

GRIPMASTER
PATENTED
POLISHING WHEEL CEMENT

LEADING PLANTS REPORT:

GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

Now! **Longer Wheel Head Life!** Thanks to Gripmaster's special high-heat resisting ingredient!

Now! **Fewer Stops for Wheel Changes!** Gripmaster *locks in* grains of emery "wise tight!"

Now! **Inventories Simplified!** One grade grips *all* grains—300 to 20. No special sizer needed!

Now! **Better Finishes!** Greater flexibility gives more and finer "breaks" when wheel is "cracked!"

Now! **Goodbye to S. O.!** There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"

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Windsor, Ontario

☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.
☐ Have a representative call to demonstrate.

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ATTENTION_____
ADDRESS_____
CITY_____ STATE_____

P-150

A. E. S. 37th ANNUAL CONVENTION BOSTON, JUNE 12-15

The Host Branch

The Boston Branch of the American Electroplaters' Society will celebrate its 30th anniversary only a few days after the 1950 Convention has closed.

It was on June 20, 1920 that a number of platers and chemists gathered at the Adams House for the purpose of organizing a Branch. Frank J. Clark, then of the New York Branch, and Samuel Herrick, a Bostonian who belonged to the Providence-Attleboro Branch, were the initiators.

The latter, serving as a temporary chairman, discussed the benefits derived from membership in the Society, and A.E.S. Secretary-Treasurer John E. Sterling of the New York Branch described the Society's origin and the work of its Branches. After two members of the Providence-Attleboro Branch, Messrs. McDonough and Simpson, had told about the success of their Branch, "all present were anxious that a Branch be formed and a temporary charter applied for".

The following were then elected officers:

President—FRANCIS W. MACKIE
Vice-President—WILLIAM FRENCH
Secretary-Treasurer—A. TALAMONO
Recording Secretary—ANDREW W. GARRETT
Librarian Instructor—H. H. WITCOMB
Sergeant-at-Arms—GEORGE C. LEACH
Trustees—J. J. NIHAN, LOUIS A. GALE, B. K. DINJIAN, H. H. WITCOMB, and R. A. LAFEAU

The reporter of the day, Mr. Herrick, comments on the fact that among the officers there were one chemist and two electrochemical engineers.

Thirteen men (there must have been three who did not hold any office) then signed the application for a temporary charter which was granted shortly thereafter. The new Branch received its permanent charter on December 31.

Among the actions of the group at its first meeting was to decide to enlist the aid and cooperation of one of the large educational institutions in Boston. That this was successful is indicated by the election, on May 6 of the following year, of Dr. M. deKay Thompson, professor of electrochemistry at the Massachusetts Institute of Technology, as an honorary member.

The first few meetings were held in the Quincy House, but they were soon moved to the American House. At each meeting—soon there were two meetings held each month—one or more papers were given on the usual plating subjects or, appropriately enough in view of the 1950 Convention program, on electroforming including electrotyping and manufacture of phonograph records. A regular feature, which was very popular, was a series of lectures on chemistry by the first President, Mr. Mackie.

With the addition of social affairs, the first one of which was held on Lincoln's Birthday, 1921, the Branch during its first year grew steadily in membership with at least one new member being added each month. Stagnation soon set in, however, and the membership remained at twenty-five or less until 1925—when it dropped to fourteen. The turning point was reached in 1929–1930 when from eleven members the Branch grew to thirty. It remained that way until Donald Wood became President. Under his leadership and that of his immediate successor, Arthur Mintie, the membership rolls showed sixty-three members in 1936, eighty in 1937, and ninety in 1938. It continued to grow until 1946 when a top figure of one hundred and sixty-eight was reached. At this writing, due to many local changes, the Branch has one hundred and thirty-six members.

As one looks through the records one is impressed by the long and devoted services given by several individuals. The outstanding record is held by Andrew W Garrett who was the Branch's Secretary-Treasurer almost from the very beginning until 1946 when he exchanged this post for that of President. He is now a member of the Board of Managers.

Other old-timers who have served long and well are Francis W. Mackie and Louis A. Gale, who were the first and second Presidents of the Branch respectively. Mr. Mackie is now an old man who retired a number of years ago but still shows up on occasion. Mr. Gale, a younger man, is still active and is in charge of plant visitations at the forthcoming Convention.

The present officers are:

President—LOUIS V. GAGNON
Vice-Presidents—EDMUND S. JEVELY and EUGENE P. CARTER
Secretary-Treasurer—DR. GEORGE P. SWIFT
Librarian—MANSON GLOVER
Sergeant-at-Arms—JAMES L. ANDERSON
Board of Managers—ANDREW W. GARRETT, WILLIAM HARVEY and WILLIAM M. MEAD

The Boston Branch put on an excellent Convention in 1941, and all look forward to an equal performance in 1950.

A. E. S. News

Detroit Branch Starts Drive for Sustaining Members

Following a great deal of preparatory work the Detroit Branch has launched an intensive drive for sustaining members.

The immediate reason is the need for more information about water pollution by plating chemicals and the desire to provide funds whereby A. E. S. Research Project No. 10 may be expanded and accelerated. To quote from a letter which is part of the solicitation "package":

"The costs of necessary research, engineering, installations and operations involved are prohibitive to small business and practically so to the majority of large firms. Therefore, it is absolutely essential that early cooperative effort be made by all concerned to accomplish a solution (of the pollution problem) at lowest possible cost . . . (and) to avoid prosecutions under activation of laws now in effect . . ."

The aforesaid package, which is being sent to a large number of concerns doing plating, consists of the letter, which includes (1) the names of Branch officials, A. E. S. Executive Board and Research Committee members, and Detroit Branch Research Committee members, with their company affiliations, (2) a list of sustaining members, and (3) excerpts from testimonials to the importance of the undertaking by the Department of Public Works of the City of Detroit and by many prominent companies; a copy of Standards and Regulations Controlling the Discharge of Industrial or Commercial Type Wastes into the Detroit Sewage Systems; a copy of the Facts about the American Electroplaters' Society; a statement about the A. E. S. Research Program and lists of Research Projects and Research Reports.

The recipients of the package are then contacted personally by sales representatives of the important supply houses operating in the Detroit area, the names of which are also listed in the letter.

The Detroit campaign is headed by W. B. Knight of Knight Plating Company, 3143 Bellevue Avenue, Detroit 7, Mich., Chairman of the Detroit Branch Research Committee and representative of the A. E. S. Research Finance Subcommittee. Other members of the Detroit Committee include R. M. Shock, Secretary of The Plating Institute; C. E. Heussner of Chrysler Corporation, J. L. McCloud of Ford Motor Company, W. M. Phillips and C. F. Nixon of General Motors Corporation, W. L. Pinner of Houdaille-Hershey Corporation, A. D. Wagner of Hudson Motor Car Company, and F. E. Olmstead of Packard Motor Car Co.

A National campaign patterned after the Detroit campaign is also being organized. It is intended to begin in certain key Branches and gradually expand the effort to other Branches.

New Year's Greetings

We wish to extend to all our old friends and prospective new ones

A Very Happy and Prosperous New Year

HARRISON & COMPANY
Incorporated
HAVERHILL
MASSACHUSETTS

Branch News

Coming Events

CHICAGO BRANCH
ANNUAL EDUCATIONAL SESSION AND BANQUET
Saturday, January 14, 1950
in Stevens Hotel

Educational Session at 2:00 P. M.

Speakers: Dr. William Blum, National Bureau of Standards, Washington, D. C., "New Direction in Research"
Mr. R. O. Hull, R. O. Hull & Company, Cleveland, Ohio, "Factors Affecting Throwing Power"
Dr. B. B. Knapp, Research Laboratory, The International Nickel Company, Bayonne, N. J., "New Developments in Nickel Plating"

Banquet at 7:00 P. M.

Tickets at $7.50 each. Make early reservations with Mr. Paul P. Glab, 882 N. Paulina St., Chicago 22, Ill.

R. F. LEDFORD, *Correspondent*

DAYTON BRANCH
FIFTH ANNUAL EDUCATIONAL SESSION AND DINNER-DANCE
Saturday, February 25
in Hotel Biltmore

Educational Session at 1:30 P. M.

Honorary Chairman: A. E. S. FirstVice-President Wm. JNeill

Speakers: Mr. Jack Winters, Research Chemist, R. O. Hull and Company, Cleveland, Ohio, "Control of Plating Solutions by Hull Cell"
Mr. A. W. Bell, Manager, Behr-Manning Corporation, Troy, N. Y., Subject to be announced
Mr. A. W. Cook, President, Fax Film Corporation, Cleveland, Ohio, "Fax Film Method of Comparing Surfaces"

Presentation of Awards: The Toulmin and the Dayton Awards, and the Award to the winner of the High School Contest for the best essay on "How Plating Affects Our Daily Lives"

Dinner-Dance at 6:15 P. M.

Dinner music—Floor show—Dancing to Earl Holderman's Orchestra

Tickets at $5.00 per person

Dress optional

CORLISS W. POWELL

GRAND RAPIDS BRANCH
12TH ANNUAL EDUCATIONAL SESSION AND DINNER-DANCE
Saturday, January 28
in the Pantlind Hotel

Educational Session at 2:00 P. M.

Chairman: W. M. Phillips, Head of Electro-Chemistry Department, General Motors Research Laboratories

Speakers: Mr. W. M. Tucker, Chairman of the Research Committee, American Electroplaters' Society, "A. E. S. Research Grows Up"
Mr. G. M. Cole, Ternstedt Division, General Motors Corporation, "The Reporting and Use of Research Data"
Dr. R. A. Schaefer, Cleveland Graphite Bronze Company, "Current and Metal Distribution in Commercial Application"

Dinner at 7:00 P. M.

Floor Show—Dancing from 10:00 P. M.

Reservations: Jack Haney, 129 Arthur N. E., Grand Rapids, Mich. Telephone GL-40109

DONALD SCHANTZ, *Librarian*

BALTIMORE-WASHINGTON BRANCH

The regular monthly meeting was held on November 8 in Washington, at the Dodge Hotel. Over thirty members were present. Among the items covered in a brief business session were National Society news, election of one new member, and introduction of several members who recently transferred to the Branch.

LIBRARIAN WALTER OLSON introduced the speaker of the evening, MR. GEORGE W. JERNSTEDT of the Westinghouse Electric Corporation, East Pittsburgh, Pa., who gave a very interesting talk on "PR Cyanide Copper Plating". A question period of 30 minutes which followed his talk testified to the strong interest in this new process.

Beer and soft drinks were served during the social period following the meeting.

VERNON A. LAMB, *Secretary*

BRIDGEPORT BRANCH

The regular monthly meeting was held on October 7.

One applicant was elected to membership and one new application was received. Two previously suspended members were reinstated. One member was suspended.

It was decided to purchase a lantern-slide projector adjustable to different sizes of slides at a price not exceeding $100.00.

FRANK W. ROCK reported that the Canadian Bureau of Mines, Ottawa, Canada, has available on request a "Booklet on Abrasives" in four parts at 30 cents each.

C. C. HELMLE then entertained the group with pictures taken during his travel through the country.

Refreshments were served through the courtesy of ART MCNEIL of the MacDermid Company, Waterbury, Conn.

JOSEPH G. STERLING,
Secretary-Treasurer

BRIDGEPORT BRANCH

MR. GEORGE W. JERNSTEDT, Manager of Electroplating Projects, Westinghouse Electric Corporation, East Pittsburgh Pa., gave a very interesting talk on "Cor-

THIS MODERN MAGIC WILL WORK FOR YOU

Improved

Miccrosol E-1003

Heat-Cured Rack Coating

★ **Amazing Tensile Strength and Scuff Resistance**
★ **Permanent Flexibility**
★ **Positive and Continuous Adhesion**
★ **Simplicity of Application**

Platers who use Improved MICCROSOL E-1003 call its miraculous performance and long life on the job "Modern Magic" . . . magic that steps up production while saving both time and money.

Developed to meet today's severe demands, this vastly improved, rugged rack coating is "modern" in every way. It gives you the utmost in performance, durability, and economy.

If for some reason our salesman in your territory is not contacting you regularly, and you would like some additional information on Improved MICCROSOL E-1003, we will be glad to send you a detailed bulletin. WRITE US TODAY!

MICHIGAN CHROME & CHEMICAL COMPANY
6351 East Jefferson Avenue
Detroit 7, Michigan

MICCRO Products

AT YOUR SERVICE . . . **The applicators listed below are all equipped to cover your racks with Improved MICCROSOL E-1003. Call the one nearest you for immediate service.**

ANKOR PLATING RACK COMPANY
311 E. Carpenter . . . . . Cudahy, Wisconsin
AYERS ENGINEERING, INC.
1424 Madison Avenue . . . . Indianapolis, Indiana
BELKE MANUFACTURING COMPANY
943 N. Cicero Avenue . . . . . Chicago, Illinois
GLENN BUTLER PLATING RACKS
Kalamazoo, Michigan
CLEVELAND RAC-COTE COMPANY
1515 E. 40th Street . . . . . Cleveland 3, Ohio
DAVIES SUPPLY & MFG. COMPANY
2315 Delmar Avenue . . . . . St. Louis, Missouri
DE LUCIA MANUFACTURING CO.
2710 Chestnut Street . . . . . Toledo, Ohio

FUTURA, INC.
2323 W. Maryland . . . . . Evansville, Indiana
GLOVER COATING COMPANY
376 Washington Street . . . . Malden 48, Mass.
IMPERIAL PLATING RACK CO.
800 Industrial Street . . . . . Flint, Michigan
INDUSTRIAL RACKS, INC.
Waterbury, Conn.
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Chicago Branch in Western Society of Engineers' Building

rosion" Resistance of Periodic Reverse Deposits" at the Open Meeting and Educational Session on October 21. With numerous slides for illustration he showed that properly controlled PR deposits of nearly all common metals, such as nickel, silver, and brass, have a maximum leveling action. Because of the dense, pore-free structure, corrosion resistance is greatly increased. However, simple PR plating in baths without proper inorganic addition agents in most cases actually produces unwanted results.

A lively discussion followed the talk.

JOSEPH G. STERLING,
Secretary-Treasurer

1950 BUNATOL
It's New

With the new year we announce a new rack insulation, BUNATOL No. 1002 which we believe represents the last word in the Plastisol type of insulation.

Through the use of some of the newest developments in synthetic resins, we have formulated in No. 1002 a baking rack insulation that has unusual toughness and tensile strength; very high gloss with ease in rinsing without drag out; a single primer coat that gives remarkable adhesion to the rack. The chemical resistance of this super tough heavy coating is so good that long use, in any kind of plating solution, has almost no effect.

Another point is the extra fluidity of this new Paste material. That makes dipping easier and also insures that air bubbles will not stay in the material. A single dip makes a heavy coat yet the thick coating is firm, stiff and very tough with life-time flexibility. It's new.

BUNATOL No. 1002 is simple and easy to use. An average of three hours to insulate the average rack. Time is saved. In many cases, the insulation will last as long as the rack. The actual cost of labor and material is small compared to the life of the insulation.

May we send you complete data on this new 100% solids Plastisol? Or send us a rack for a test insulation. No. 1002 will help to reduce operating costs.

Nelson J. Quinn Company — Toledo 7, Ohio

BUFFALO BRANCH

On November 4 the Branch was the guest of the Carborundum Company in its Coated Products Plant in Niagara Falls, N. Y.

The evening started off with a delicious dinner in the plant cafeterin. As a second dessert the members were taken on a tour of inspection of the plant where they learned how abrasive belts are made. The plant, less than a year old, is equipped with some of the most modern equipment available for their manufacture and is said to be one of the largest of its kind in the country.

The inspection tour was followed by a visit to the "clinic", where a dynamic demonstration was given of the versatility of coated abrasives in metal finishing. Some of the members had brought samples of parts which presented difficult polishing problems. Many agreed that here they had found the answer.

A vote of thanks was extended to Messrs. VAN AENEB, ROGERS, KHOURY, AUST, MARTIN, and HANNAN, members of the Carborundum staff who contributed much to the success of the evening.

H. A. FUDEMAN, *Secretary*

CHICAGO BRANCH

At the November 11 meeting forty-two members and guests were present for dinner and a total of one hundred attended the general meeting. Our good friend, KLEM PETROSIUS of Bell & Howell Company, snapped numerous pictures of the group in the lounge, at dinner and in the auditorium.

The speaker of the evening, MR. BERNARD MARTIN of McGean Chemical Company, gave an interesting talk on "High Speed Bright Nickel Plating". The major portion of Mr. Martin's talk was devoted to the presentation of laboratory data showing the effects of variation in concentration of bath constituents, as well as of operating conditions, on permissible current density. The usual discussion period followed.

RAYMOND F. LEDFORD, *Correspondent*

CLEVELAND BRANCH

The first regular meeting of the 1949–1950 season was held at the Hotel Cleveland on November 4. In the absence of PRESIDENT E. C. FRIEDL, FIRST VICE-PRESIDENT L. N. ELICKER conducted the meeting.

Prior to the business meeting, Dr. A. M. Max, Manager of Development Section, R. C. A., Indianapolis, Ind., delivered an absorbing lecture on the development and manufacture of Victor Records. Of special interest was his discussion of the processes of electroforming the "stampers" which are used for molding records under heat and pressure.

Five candidates and one in-transfer were elected to membership, and a list of nineteen members about to be suspended for delinquency in dues was read.

Before adjournment, it was announced that the Summer Outing had netted a profit of $92.75, part of which was converted into liquid form for the refreshment of the members present.

HARRY POCHAPSKY, *Secretary*

DAYTON BRANCH

Our third regular meeting was held at the Engineers' Club on November 7.

MR. HERMAN AUSTEN, Research Engineer with the National Cash Register Company and one of our Branch members, gave a talk on "Industrial Waste Disposal". The lecture covered the types of waste normally encountered from plating rooms. The tentative standards for the Great Miami River, into which the wastes from local plants enter, were given. It was stated that the foremost requisite for efficient disposal is good housekeeping to keep the wastes and waste waters which must be treated to a minimum. In many cases the normal flow of water from a plant is sufficient to dilute rinse waters to a point where they are no longer toxic. Cyanides present the biggest problem. They can be treated in a number of ways, such as chlorination or electrolytic decomposition to cyanates which are not nearly so toxic. The latter has been found to be the most economical method.

Mr. Austen showed some slides of an automatic sampling station used to keep continuous records of waste waters entering the river. Data obtained include *p*H, temperature, and volume of flow, and composite samples and spot samples are taken automatically for later chemical analysis.

The importance and interest in this subject was indicated by the discussion that followed.

A nontechnical color film on wild life and fishing was enjoyed by all present.

R. M. CLINEHENS, *Secretary*

HAMILTON BRANCH

The members enjoyed an innovation in the program for the monthly meeting on November 18 when BRANCH SECRETARY W. FINLAY of M. and Y. Products Ltd., and VICE-PRESIDENT E. K. CRANFIELD of Oakite Products, Inc., presented papers on "The Plating of Die Castings in a Die-cast Nickel Solution" and "Alkali Cleaning in a Plating Shop", respectively.

Mr. Finley described in detail what he considered to be the best formula for a diecast nickel bath and explained the chief purposes of the chemical components in the solution. The speaker mentioned the means by which the bath could be visually controlled and suggested suitable plating thicknesses and over-coatings for the die-cast nickel deposits. He made reference to satisfactory methods of purification of contaminated solutions, including the use of corrugated dummy cathodes.

Giving a complete picture of metal-cleaning techniques in the plating shops, Mr. Cranfield listed the more familiar types of alkali cleaners, solvent cleaners, and acid pickles and indicated their applications. Particular attention was given to alkaline cleaning materials which were divided into saponifiable, emulsifiable, and inhibited cleaners. Recommendations were made for cleaning ferrous and nonferrous materials, and the reasons for the particular choice of procedure were elucidated.

PRESIDENT W. YOUNG moved a vote of thanks to the speakers for their enlightening and interesting papers and encouraged the members to prepare and present papers which would be of interest to fellow members. The meeting adjourned after a short discussion period.

G. M. DALTON,
Review Correspondent

HARTFORD BRANCH

The meeting on November 21 at the Bond Hotel was attended by approximately one hundred and fifteen members and guests. Preceding the meeting a color movie was shown, entitled "Bright Nickel and Decorative Chrome Plating" which had been produced by A. E. S. PRESIDENT

SHOW A NEAT FIGURE

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A. W. Logozzo with the cooperation of several local firms. Mr. Logozzo made brief comments throughout the showing, and Mr. Newell commented on the spectrographic operations shown.

The speaker for the evening was Mr. Frank C. Mesle, Works Laboratory, Oneida, Ltd., whose subject was "Practical Silver Plating". Mr. Mesle gave many examples, taken from his wide experience, of how such problems as peeling, poor adhesion, and lack of plate on some surfaces were due to carelessness in making additions to the bath or forgetting to make proper additions at the right time. The use of agitation and correct temperature to increase the current density for faster plating of bearing surfaces was mentioned. The importance of the use of the Hull Cell for studying the detrimental effects oftoo much brightener on current distribution was brought out.

Mr. Manson Glover of the Boston Branch invited the members to the Boston Convention in 1950 and gave a preview of the hospitality that the members would receive. Dr. H. L. Kellner of the Lea Manufacturing Company gave a demonstration of the use of the "Lectromag" for measuring the thickness of nonmagnetic coatings on steel..

Kermit T. Simons acted as the technical chairman, and refreshments were served through the courtesy of The Pilot Chemical Company.

Stanley Platoz, *Secretary*

JACKSON-LANSING BRANCH

The third meeting of the season was held on November 15 at the Meadowlark Inn, near Jackson, with an attendance of sixty-two.

The Wagner Brothers Company of Detroit sponsored the dinner, and Mr. L. R. Gallos presented a paper covering "The Application of Secondary Treatments of Zinc Surfaces". A question period followed this presentation.

A color movie, "Nevada and Its Natural Resources," was shown.

At a special meeting held immediately after the regular session President L. M. Henderson created two new committees: a Membership Committee to be headed by Jim Brakeman and a Display Committee to be headed by William Mogle. This last named group is to work on a plan to display parts finished by manufacturers and jobbers in our area. This display can then be shown at State and National Meetings.

Fred W. Stuckenberg, *Publicity*

LANCASTER BRANCH

The October meeting of the Lancaster Branch was held in the Stevens Trade School on Friday the 14. The speaker was Mr. John Dobson of the Foxboro Instrument Company, who spoke on "Plating Room Wastes". Outlining methods for their disposal, he presented typical installation diagrams featuring the instrumentation which made them practical and the results positive. He also outlined the procedures and controls necessary to satisfy the requirements of the Pennsylvania State pollution laws. Following a question period, a rising vote of thanks was given for an excellent presentation.

Chester W. Smith, *Secretary-Treasurer*

LOS ANGELES BRANCH

The regular dinner meeting on October 12 drew fifty-eight members and guests.

Mr. Don Vance of the Kelite Company addressed the group on the subject of "Metal Cleaning". The question box produced several interesting questions.

The balance of the evening was spent in hearing reports on the Milwaukee Convention from each of the delegates. Don Bedwell reported that the possibility of placing a research project at one of the West Coast universities had been discussed with Dr. A. K. Graham.

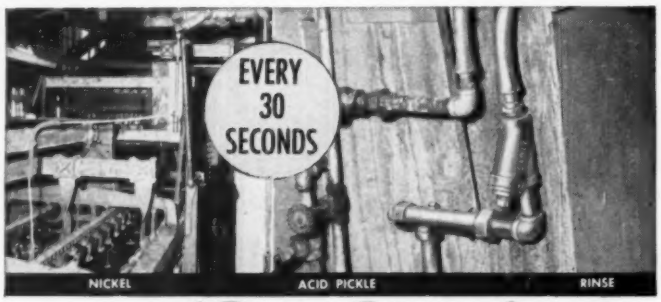
Ed Wells stated that a 15-minute television show demonstrating the process of electroplating has been arranged for Sunday, January 7 at 9:30 A. M.

M. H. Orbaugh, *Secretary*

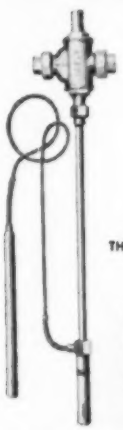
LOUISVILLE BRANCH

Business at the October 27 meeting at the University of Louisville was postponed to give Dr. A. K. Graham, Executive Secretary of the Society, full time to address the Branch.

Dr. Graham first explained the nature of the A. E. S. Research Program—how it was sustained and managed. A discussion of the Research Program followed. He then presented information about rapid plating of copper-zinc alloys at



A Perfect Plating Operation



Automatic plating units never wait. When they hit the tanks, the temperature must be right and in less than a minute the job must be done—right. In the busy plating plant illustrated, every step is temperature controlled—sometimes with the inexpensive Sarco No. 87 Trap-Control—at others with the more exacting TR-22 control.

The result is mass production with a high accuracy that is repeated, day in and day out. Reduction in the number of rejects paid for these controls in a few months. And the strange thing is that less heat is wasted when perfect plating is secured with Sarco Controls.

Eventually you will find your plant in competition with temperature controlled plating. Why not look into the question now and save the original cost of the controls over and over for years to come? The Sarco Representative near you will be glad to show you how. Ask for Sarco Catalog No. 650 on plating and finishing controls.

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higher temperatures and higher concentration of metals than are commonly used today. The talk was documented with samples, graphs, and tables clearly explaining the details of operation and control.

Dr. Graham was heard by the largest group of members and guests yet to gather since the local charter was issued.

STANLEY J. BEYER, *Secretary*

MELBOURNE BRANCH

The regular meeting on October 20 had an excellent attendance of forty-three members and visitors. Seven new members were admitted.

The address was given by BRANCH LIBRARIAN HUGH TEAGUE. Discussing "Bright Nickel Plating", the speaker traced the historical development of the modern types of bright nickel plating solution and drew a distinction between those which required a polished base and those which would brighten a dull base. Brightening agents used in modern baths were listed.

A lively question time ensued, highlighted by discussions of the types of heaters and tank linings which should be used in bright nickel baths and of the compositions of solutions which the speaker would recommend.

JOHN J. DALE, *Honorary Secretary*

MILWAUKEE BRANCH

The 404th meeting held on November 4, was a dinner meeting in the Pere Marquette Room of the Schroeder Hotel. All business was set aside in honor of MR. WALTER PINNER, Manager of Research of the Houdaille-Hershey Corporation, Detroit, Mich., who visited us for the 16th consecutive year.

After an excellent dinner CHAIRMAN RODNEY OLSEN introduced our guest. Mr. Pinner spoke about the "Perflow Process of Nickel Plating" and, with the aid of slides, discussed its application, advantages, and limitations. The interest in the speech prompted many questions which Mr. Pinner very capably answered.

HARRY J. KRUEGER,
Secretary-Treasurer

MONTREAL BRANCH

Twenty-eight members and guests were present at the regular meeting on November 1 to hear Mr. F. C. MESLE of Oneida, Ltd., present a paper on "The Problems and Progress of Silver Plating".

J. H. FEELEY introduced the speaker, who then discussed how problems may originate either outside the plating room, usually when incorrect materials have been supplied to the plater, or in the plating room, usually when standard instructions have been disobeyed, either deliberately or unknowingly. One of the most frequent sources of trouble is in the addition of too much brightener. Such additions should be stopped when the ratio of plating thickness on protruding and recessed spots becomes higher than a predetermined value. Speed of silver plating has risen from 3-8 asf in the earlier baths to more than twenty times those current densities in modern baths. Electropolishing is now used to reduce the buffing time on the finished product. Many members took advantage of the question period which followed.

Five applicants were elected to membership.

GEORGE R. KING,
Secretary-Treasurer

NEWARK BRANCH

Seventy-five members and guests attended the Open House on October 21 in Robert Treat Hotel.

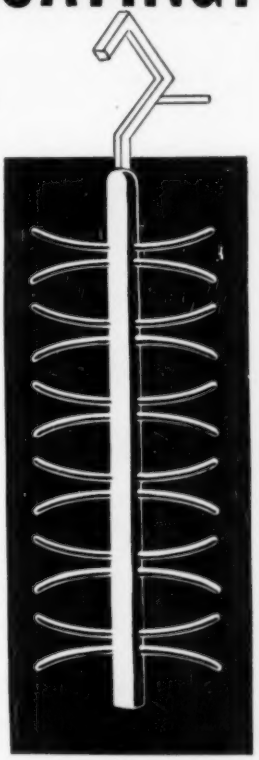
Two applicants were elected to membership. A Christmas Party Committee was appointed by PRESIDENT EDWIN BOWERMAN, which consists of the following members: HORACE SMITH, Honorary Chairman; GEORGE WAGNER and JOHN DE VRIES, Hotel and Banquet; GEORGE REUTER, Tickets; WILLIAM BRUHNS, Publicity; PAUL OLDAM, Entertainment; LOUIS DONROE, Reservations; and ROBERT EHRHARDT, Educational.

LIBRARIAN ROBERT EHRHARDT led a discussion period of ways in which meeting attendance might be increased. A.E.S. THIRD VICE-PRESIDENT MR. F. J. MACSTOKER closed the discussion with remarks about his experiences in this field.

Two movies were shown, one in color of the growth of tree farms in the West, the other of some important sports events. PAUL OLDAM, Newark's one and only magician-plater, then delighted the group with many magic tricks, some of which were shown for the first time.

EVERYTHING YOU NEED IN A RACK COATING!

Unichrome Coating 218X—a plastisol—provides this top combination of properties needed for real service:



You get the ideal rack protection in Coating 218X. For (1) it resists abrasion and impact—so Coating 218X is not prone to mechanical damage! (2) It stands up in acids, and hot alkaline solutions, and even *degreasers*—so you can work it through *any* plating cycle! (3) This coating is easy to apply and has unusual adhesion! (4) To cap it all, a United Chromium Service Engineer gives you any technical help you require to do a top quality coating job.

No wonder Unichrome Coating 218X rates "EXCELLENT" in the report of a leading automotive producer. Another company is covering every chromium plating rack in the plant with it. A third user affirms never having a coating able to take rough handling and hundreds of vapor degreasing cycles like this plastisol! So it goes in hundreds of plants—longer service, lower costs.

You too can be sure of satisfactory applications. Get acquainted with "218X"—you'll profit by it. Write for more data.

Nearby applicators can do the coating job for you if you have no baking oven. Ask for names.

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ROBERT HORROCKS, Branch Exhibit Chairman for last year's Convention had secured an exhibit of the manufacture of recording sound discs from a master copy, courtesy of M. G. M. Recording, Inc., and had placed it in the meeting room for inspection.

Beer and sandwiches were served to top off the finest social gathering of the year. Most of the crowd stayed around to meet their old friends and make new acquaintances.

SAMUEL S. FREY, *Recording Secretary*

NEW HAVEN BRANCH

The first educational meeting of the season was held on September 13 in the Sterling Laboratory of Yale University. The following officers for the new year took office:

President—HENRY B. SMITH
Vice-President—MALCOLM A. ORR
Secretary-Treasurer—BERNARD J. GAFFNEY
Librarian—ROBERT T. SAMMET
Assistant Librarian—GEORGE A. TRACCHIO
Sergeant-at-Arms—GEORGE R. MERRIAM
Historian—JOHN W. ENGLISH
BOARD OF MANAGERS—H. L. KELLNER, W. T. LYNCH, J. M. BARRY

WALTER LYNCH introduced MR. GUY CUMMINGS of Frederic B. Stevens, Inc., Detroit, Mich., who spoke about "The Application of Motor Generators and Rectifiers in Plating Operations". Having personally worked with rectifiers and generators, Mr. Cummings had a vast store of knowledge to impart and cleared up various ideas in regard to limitations of rectifiers and heavy-duty value of generators. Speaking of engineering possibilities of both units he was able to give the platers a valuable and instructive evening. A lengthy discussion period followed.

B. F. GAFFNEY, *Secretary-Treasurer*

NEW YORK BRANCH

The Branch held two meetings during October, officially launching the program planned by its new officers.

The meeting on October 14 was attended by seventy-six members and saw the election of four new members and the receipt of three additional applications for membership. A lively Question and Answer session was the feature of this meeting, with most of the questions coming from supply men this time.

The October 28 meeting was filled with factual information for our jewelry and precious-metal platers, not less than one hundred and sixty-five members attending to hear DR. K. SCHUMPELT of Baker & Company discuss "Rhodium Plating".

The advisability of a nickel undercoat for rhodium on all basis metals except precious metals or their alloys (such as white gold) was stressed. The porous 5 millionths of an inch rhodium coating does not offer much protection and is lifted by corrosion products of unnickeled basis metals.

Although the rhodium phosphate bath has the advantage of covering an almost insufficient nickel deposit in recessed areas, the sulfate bath was preferred for lead base alloys because insoluble lead sulfate might form in case of insufficient nickel.

The development of better methods of forming rhodium concentrates was discussed, along with formation of complexions of rhodium salts, the presence of which is shown by the incompleteness of chloride or sulfate precipitations by silver nitrate or barium chloride respectively.

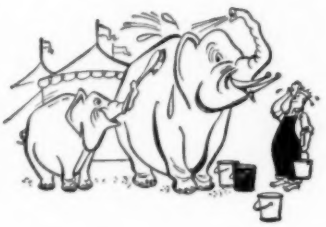
Heating a rhodium solution above 130-140° F results in a shift in the complexion equilibrium whereby the solution becomes enriched in rhodium ions with resulting ill effects such as streaking and burnt deposits.

To prevent precipitation when rhodium concentrate is added to water prior addition of acid was recommended when a new bath is being prepared. An acidified dragout rinse was recommended for the same reason.

Purification of rhodium solutions was not considered good economics. The potassium ferrocyanide treatment usually necessitates a carbon treatment to adsorb decomposition products, and unfortunately the carbon retains a substantial amount of the precious metal.

MR. ED RINKER of the Bart-Messing Corporation followed with a paper on "Factors Which Affect the Color and Shade of Gold Deposits". However,

Start Clean . . .
Stay Clean



It's Easy To Keep Your Plating Bath Clean
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There's not much sense to spending a lot of time, labor, and money in cleaning work for plating then putting that work into a dirty plating bath! *Start* clean . . . *stay* clean! Use Darco S-51 to keep your plating bath free of the impurities that cause trouble.

Darco S-51 traps impurities that ordinary filtration alone does not remove —adsorbs them to *its* surfaces—before they can be deposited on the freshly cleaned surface of your work. You get better work at lower cost in bright nickel, copper, iron, zinc, cadmium, tin, gold, and silver solutions.

Red Label Darco S-51 is especially treated for use in plating—*it is the only carbon that will meet the benzol-mercury test!* Red Label Darco S-51 is especially easy to handle . . . to wet . . . and to incorporate into a slurry. Darco technicians are ready to show you how to make the most of Darco's advantages. Place an order for Red Label DARCO S-51 with your regular plating supply house today . . . practically all leading suppliers carry it in stock. DO NOT ACCEPT SUBSTITUTES.

Is your plating bath as clean as the water in your final rinse?

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since Dr. Schumpelt's talk because of the fine reception had taken most of the available time,Mr. Rinker limited himself to a resumé of his subject. (Besides, he too was thirsty!)

Refreshments were served to the further enjoyment of the membership.

ALBERT FUSCO, *Recording Secretary*

PHILADELPHIA BRANCH

The regular October meeting was held on the 28th at the Harrison Laboratory, University of Pennsylvania, with fifty-two members and guests attending.

The speaker was DR. WALTER R. MEYER, President of Enthone, Inc., whose topic was "Bright Dipping of Metals". For a solution to have bright dipping characteristics, the following three conditions must be met: high rate of metal dissolution; oxidizing medium; formation of film during process. The patent literature on bright dips for cadmium and zinc was summarized and the chromic-sulfuric acid type discussed in greater detail. A typical good formula is chromic acid, 32 oz/gal; nitric acid, 7 fl oz/gal; sodium sulfate, 10 oz/gal. The following nonfuming bright dip for copper and copper alloys was developed by Dr. Meyer while with General Electric Company: sulfuric acid, 5 qt; nitric acid, 1½ qt; chromic acid, 8 lb; water, 3 gal; hydrochloric acid, 2 fl oz (makes 5 gal). No good bright dip is yet available for silver, the cyanide-peroxide type being quite dangerous to use. The same is true of tin (best method is heat flowing either in hot oil bath or electrically), steel, and lead.

Orthophosphoric acid plus nitric or acetic acid or both, together with water in an amount depending on results desired, at different specified temperatures, are used to bright dip aluminum in preparation for plating or anodizing.

Seven new active members were admitted.

The meeting was concluded with a showing of the sound-and-color film, "The Story of Tinplate", produced by the U. S. Bureau of Mines at the Weirton Steel Company. It was a well-made and interesting film.

I. WM. MARCOVITCH, *Secretary*

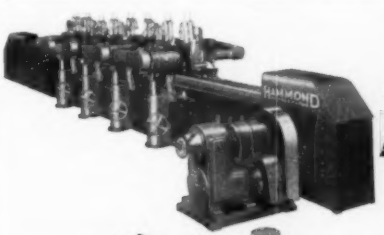
PHILADELPHIA BRANCH

The Annual Educational Session was held in the Broadwood Hotel on November 19. PRESIDENT HEIMAN welcomed the one hundred members and guests present and turned the chair over to SESSION CHAIRMAN ROBERT H. TIEBS, who introduced the speakers.

The first speaker was DR. WILLIAM BLUM, Chief of the Electrochemistry Section, National Bureau of Standards, whose topic was "New Directions for Research in Electrodeposition". The development of new tools was one direction. Described as a new research tool were radioactive materials. Thus radioactive chromium 51 has been employed as a tracer element to determine that in the typical chromic acid plating bath chromium is definitely deposited from the hexavalent state only and to study the behavior of the sulfate radical. The thickness of a deposit has been measured using radioactive cobalt or beta rays, the composition of alloy deposits and the efficiency of cleaning methods with radioactive metals and substances in the alloy and soil respectively. Other new tools include X-rays to determine crystalline forms, electron diffraction to measure cleaning efficacy, the spectroscope for checking composition and purity of plating solutions and thickness of deposits. Dr. Blum also discussed the desirability of obtaining practical commercial methods of plating molybdenum, tungsten, titanium and zirconium and some recent methods which have been attempted to obtain suitable procedures.

The second speaker, MR. ALFRED DOUTY, Chief Chemist of the American Chemical Paint Company Ambler, Pa., spoke about "Pickling, Inhibitors and Embrittlement". He described new developments in descaling steel including the fused caustic soda-sodium anhydride method, the flue-gas-and-chlorine method, and the hot salt baths used to soften scale for easier removal. Discussed in detail were the theories and methods of acid pickling, the theory of inhibitor action, the use of inhibitors in plating and precautions to be observed.

The final speaker was MR. HENRY MAHLSTEDT, Sales Manager of the Electrodeposition Division, United Chromium, Inc., New York City, who discussed "Chromium Plating". The self-



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regulating, widely used new chromium plating that maintains a constant catalyst ratio was described, including the following advantages: wider bright plate range, higher cathode efficiency, higher permissible current density, no chemical analysis required for ingredient control, no rainbow effects or staining, bright plate at lower temperatures and on stainless steel, less sensitivity to current interruptions, less complicated racking for recessed parts, and higher output. Plated specimens illustrating the plating characteristics of the new solution were exhibited.

The banquet, entertainment and dance in the evening was attended by three hundred members and guests.

The Philadelphia Branch expresses its appreciation and thanks to all who helped make this affair an outstanding success.

I. Wm. Marcovitch, *Secretary*

PITTSBURGH BRANCH

The third meeting of the season was held on November 10 at the Sheraton Hotel. Approximately sixty including twenty visitors were present to hear Dr. Walter R. Meyer, President and Technical Director of Enthone, Inc., New Haven, Conn., talk on "Pickling, Scale Removal, and Stripping of Metals".

Dr. Meyer illustrated his talk with several slides. His audience made him run over time and demonstrated its interest by asking many questions during the discussion period which followed.

During the business session which preceded the talk four applicants were elected to membership and three applications for membership were accepted. Mr. Wooster reported on the progress of arrangements for the December social meeting which has been named Milwaukee Night. President Leo Schmitt named John Davidson Chairman of the Annual Banquet to be held in April.

E. J. Smith, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

It has been at least three years since the Providence-Attleboro Branch has had the honor of having a National Officer as a speaker. So it was an especially eventful evening when on October 17 President Arthur W. Logozzo presented his talk on "Nickel and Chromium Plating".

In addition to his clear, to-the-point stressing of the fundamentals of proper rack design and manufacture, good house keeping and adequate rinsing (which all too often are the causes of plating troubles rather than faulty solutions, not only in industrial plating but especially so in highly decorative precious-metal plating) his 16-mm movie of proper plating procedures was very well received. In addition to those taken in his own plant there were long sequences of automatic plating in several of the larger Connecticut plants.

It was felt and expressed by all present that such movies should be encouraged. The few shots of some of the analytical procedures suggested to the writer that such a visual aid would be of immeasurable help to all schools of electroplating to aid the instructors in teaching the proper use and care of analytical equipment. Too often important points of techniques are lost in the hurry to get an answer regardless of whether it is right or not. Too often insufficient training discourages further attempts at analysis. Movies of actual plating would also be extremely useful to complement the lecturer's discussion of plating baths.

Edward A. Parker, *President*

ROCHESTER BRANCH

A dinner preceded the meeting on November 17. It was voted to dispense with dinner meetings in the future. A more centrally located meeting place than the Ukrainian-American Club was desired. The Rochester Institute of Technology was offered for a meeting place by member Walter Swanton who is on its faculty. The subject will be reviewed by the officers and the Board of Managers.

Sylvester P. Gartland was chosen Historian. He will prepare a history of the branch to date for submission to the National Office.

The speaker of the evening was Mr. William Tucker, Chairman of the A. E. S. Research Committee and one of Rochester's own members. Mr. Tucker discussed the organization of the Research Committee and gave a first-hand account of the projects now under way. After a lengthy question-and-answer period, the Branch is more than ever mindful of what A. E. S. Research contributes to the plating industry.

Gordon W. MacDonald, *Secretary*

ST. JOSEPH VALLEY BRANCH

Twenty-two members and guests enjoyed the excellent dinner and social hour and thirty were present for the technical session on November 2.

Five guests were introduced and welcomed to the meeting. Two applicants were elected to membership and two applications were presented.

The guest speaker, introduced by Dr. Ernest Wilhelm, was Mr. Jack Winters, Chief Research Chemist and Technical Service Director of the R. O. Hull & Company, Cleveland, Ohio. Mr. Winters presented a most practical and interesting talk on the Hull Cell, including a brief history of its development. The basic functions and theory was illustrated by slides. Advantages as well as limitations were indicated, including ease of operation and simplicity of calculations. Other points covered were construction of the standard 267-ml cell, that plating can be observed during the test, that the solution itself is the only variable, actual operation of the test cycle, and comparison of plated test panels.

After the talk Mr. Winters answered many questions by the members.

Eugene Roth, *Secretary-Treasurer*

SOUTHEASTERN BRANCH

The regular monthly meeting on November 11 featured an interesting question-and-answer session ably conducted by First Vice-President E. J. Slemons of Spartansburg, S. C.

It was decided to hold the February meeting in Spartansburg, time and place to be announced later.

William T. Weymouth, *Secretary-Treasurer*

SAGINAW VALLEY BRANCH

Sixty-five members and guests attended the meeting at Zehnder's Hotel in Frankenmuth, Mich., on November 9.

An electric percolator, presented by J. C. Miller Company as a door prize, was won by Donald Blue of the Electric Auto-Lite Company, Bay City.

Manuel Ben introduced Mr. R. C. Twyning of J. C. Miller Company, Grand Rapids, as the guest speaker. Mr. Twyning gave a very interesting talk on "Buffing Compositions, Their Application and Characteristics". Mr. Twyning was graduated from the University of Michigan's Chemical Engineering School and did graduate work at the University of Pittsburgh and Carnegie Tech. He was employed at Westinghouse Corporation during the war, and at present is Vice-President and Director of Research of the J. C. Miller Company.

Movies taken by Gene Swift were shown. The pictures were taken at Pensacola, Fla., the Navy's "Annapolis" of the air.

John W. Lee, *Recording Secretary*

SYRACUSE BRANCH

The meeting on November 21 featured a motion picture, "Die Castings", shown through the courtesy of the New Jersey Zinc Company, and an interesting talk by Mr. R. L. Green of the Parker Rust Proof Company.

It was announced that the December meeting would take the form of a Christmas Dinner Party.

Attendance was twenty-two.

K. S. Parnell, *Secretary-Treasurer*

WATERBURY BRANCH

At the meeting on November 11 President George Hisert announced a new service which it is hoped will be helpful to members looking for employment. Upon request an item will be inserted in the current meeting notice announcing a member's desire for a position. This service is also available to any sustaining member listed on the Waterbury Branch letterhead who may require the services

(*Continued on page 96*)

Membership Report of the A. E. S.

Elections

BALTIMORE-WASHINGTON BRANCH: Robert L. Weston
BOSTON BRANCH: Dean M. Boundy
BRIDGEPORT BRANCH: A. Ferguson
CHICAGO BRANCH: William H. Barron, George G. Duncan, B. E. Fisher
CINCINNATI BRANCH: Charles X. Deitsch, Rolf Lindenhayn, Jr., Donald J. Kunz, Robert C. Weber
CLEVELAND BRANCH: Chris C. Allen, William J. Cannon, Robert L. Kraber, Robert M. Messner, Allen D. Russell
DETROIT BRANCH: R. V. Anderson, C. H. Armstrong, F. Beiermeister, H. Bock, H. G. Donnelly, G. H. Friedt, Jr., T. K. Friedt, H. J. McGowan, Jr., M. F. Umstead
INDIANAPOLIS BRANCH: Elmer J. Duke, Fred O. Hough, Richard Montieth
JACKSON-LANSING BRANCH: Robert M. Scott, Glen Reinhart
LANCASTER BRANCH: Arthur J. Arsenault, A. M. Roberts
LOS-ANGELES BRANCH: Jack Brossart, H. G. Carlsen, Edgar B. Delamater, Ralph V. Esten, Gladys Hedeen, Russell C. Hedeen, Sherman A. Mead, William K. Stokes, Harold Wells
LOUISVILLE BRANCH: Earl P. Bennett, F. P. Seidel, C. T. Stoecker
MELBOURNE BRANCH: C. F. Corfe, R. B. Douglas, M. W. Hall, K. Hirst, T. J. Hollinrake, W. T. Perkins, B. D. Reaburn
MONTREAL BRANCH: H. F. Beaupre, L. A. Breault, C. C. Charest, Chris Johnton, Bernard Issenman
NEWARK BRANCH: George R. Bellrose, Walter B. Kleiner, John J. Morrison, William G. Schmidt, James A. Thompson, James F. Travers
PITTSBURGH BRANCH: Donald Berman, Douglas L. Carle, John Corbit, Jr., Joseph Crookshank, James J. Glass, Robert S. Gracey, Leo C. Hinger, Charles Kloman, Joseph C. Tanner
SAN FRANCISCO BRANCH: John T. Hatcher, J. E. Kettman, Cal D. Ward
SOUTHEASTERN BRANCH: William F. Kelly, Francis S. Webster, Jr.
SYRACUSE BRANCH: L. H. Fountain
MEMBERSHIP-AT-LARGE: Kurt J. Ackermann, Richard F. Allen, James August, Werner Ruegg

Reinstatements

BOSTON BRANCH: S. Aversa, Hubert Foley, A. H. Gower, J. F. Harney, Lester F. Pope, Robert L. Smith
CLEVELAND BRANCH: A. D. Sopher
LOS ANGELES BRANCH: James M. Carter

(Continued on page 96)

Membership Competition

BRANCH	Membership April 1, 1949*	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
DETROIT	427	67	+52½	+12.3
CLEVELAND	186	17	+19	+10.2
NEW YORK	265	21	+11	+ 4.2
PHILADELPHIA	187	15	+ 1	+ 0.5
PITTSBURGH	135	19	+ ½	+ 0.4
GRAND RAPIDS†	160	..	.....	.....
CHICAGO	391	19	− 7	− 1.8
BRIDGEPORT	160	5	− 4	− 2.5
HARTFORD	133	8	− 6½	− 4.9
LOS ANGELES	217	18	−11	− 5.1
NEWARK	256	17	−20½	− 8.0
MILWAUKEE	132	9	−13	− 9.8
BOSTON	153	8	−16	−10.5
TORONTO	154	6	−17½	−11.4
SECOND GROUP				
MELBOURNE	81	21	+18	+22.2
BUFFALO	82	6	+ 6	+ 7.3
CINCINNATI	90	7	+ 6½	+ 7.2
PROV.-ATTLEBORO	109	3	+ 1½	+ 1.3
SYDNEY†	108	8	+ 1	+ 0.9
SYRACUSE	83	6	+ ½	+ 0.6
BALTIMORE-WASH.	83	7	− ½	− 0.6
ST. LOUIS	107	7	− 1	− 0.9
WATERBURY	122	3	− 1½	− 1.2
INDIANAPOLIS	104	9	− 2	− 1.9
NEW HAVEN	108	2	− 5½	− 5.1
DAYTON	98	3	− 7½	− 7.7
ROCHESTER	125	..	−20½	−16.4
ST. JOSEPH VALLEY	80	2	−16	−20.0
THIRD GROUP				
SOUTHEASTERN	38	14	+ 8½	+22.4
LOUISVILLE	20	5	+ 3½	+17.5
ROCKFORD	56	8	+ 8	+14.3
COLUMBUS	38	7	+ 2½	+ 6.6
SPRINGFIELD	50	2	+ 2	+ 4.0
MONTREAL	69	8	+ 2½	+ 3.6
LANCASTER	59	3	+ 2	+ 3.4
JACKSON-LANSING	59	2	− 4	− 6.8
SAGINAW VALLEY†	67	3	− 6	− 9.0
TWIN CITY	77	4	− 8	−10.4
ADELAIDE	76	4	− 8	−10.5
SAN FRANCISCO	71	16	−11	−15.5
TOLEDO	56	1	− 9½	−17.0
ALLENTOWN-READING	43	1	−10½	−24.4
OUTSIDE COMPETITION				
HAMILTON	...	14	+20	.....
WESTERN ONTARIO	...	19	+19	.....
AT LARGE	100	23	+ 1	.....
IN TRANSFER	22	..	− 4	.....
TOTAL A. E. S.	5,237	445	−20	− 0.4

Active Membership, December 1, 1949 5,217

*Subject to correction. †Winners of membership competition in 1948–1949.

Membership Report

(*Continued from page 95*)

Transfers

Fred J. Bryan to Chicago Branch; R. Rominski to Detroit Branch; John S. Dixon from Waterbury Branch to Hartford Branch; Richard T. Haubrich from Newark Branch; Edmund J. Quinlan to New Haven Branch; H. C. Deichert to Pittsburgh Branch; Jose Luiz de Toledo Piza from St. Louis Branch to Membership-at-Large

Resignations

JACKSON-LANSING BRANCH: D. D. Rubek

Suspensions

INDIANAPOLIS BRANCH: Marvin Crawford, Pierre R. Douglas, Emory C. Guerin, James A. Hendrickson, Carroll P. Hinchman, Earl Moore, Oscar Moore, Edw. Popp, Claude B. Smith, R. A. Stewart

Death

LOS ANGELES BRANCH: Ernest Lamoureaux

Branch News

(*Continued from page 94*)

of a plater. Other manufacturers desiring to use this service may do so by paying for the cost of the insert.

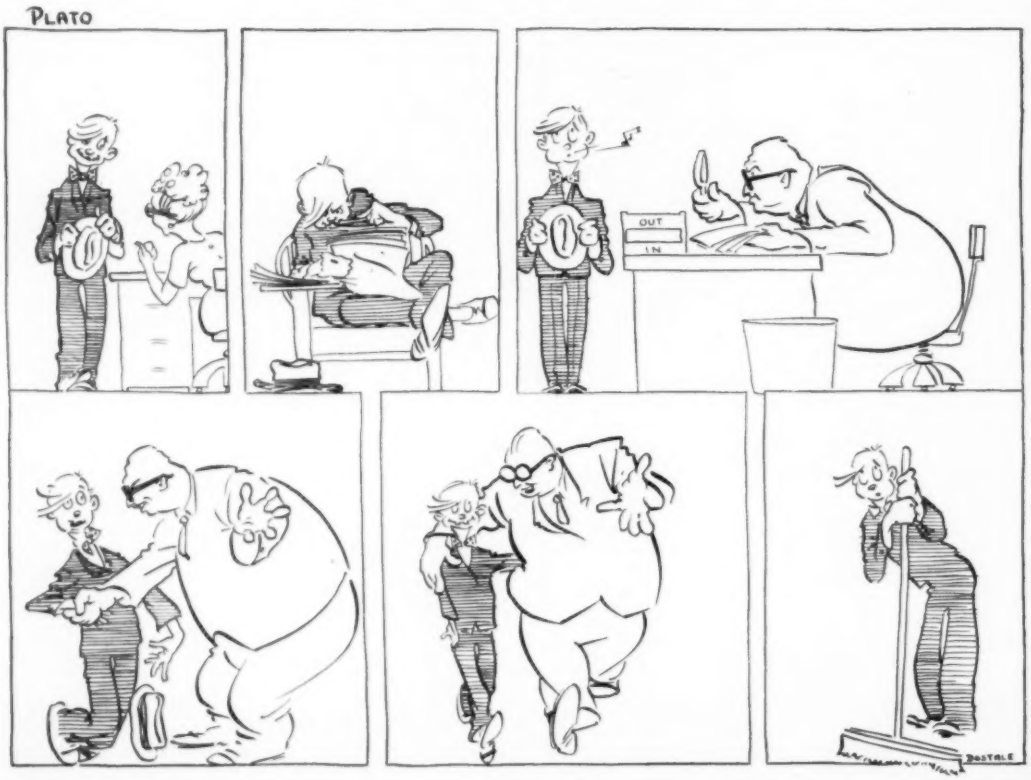
EMIL SHAKER, in covering new developments, discussed a new sand-blast gun disclosed by a recent British patent, which operates at much higher efficiency than the conventional gun. Another item that concerns platers was the development of a method of producing chromic acid from low-grade chrome ore by an electrolytic process in a diaphragm-type cell.

The movie was of unusual interest. It was a sound-and-color film, "The Tale of the Powdered Pig" furnished through the courtesy of the Reynolds Metal Company, which showed the method of manufacturing aluminum powder and the many uses to which this material is now put, particularly in paint.

HENRY STROW as technical chairman offered two interesting speakers on subjects which are closely interrelated in the plating field. DR. J. W. HASSLER, Director of Research of the Tyrone, Pa., laboratory of the Virginia Pulp and Paper Company, told the history, manufacture, and uses of activated carbon. Many materials have been employed in the production of this material, but only a relatively few, including sulfate liquor from paper making, are being used at the present. Depending on the method of manufacture various properties are incorporated in the finished product; a grade especially adapted to the particular use should therefore be selected.

MR. HAROLD W. FAINT, Sales Manager of Industrial Filter and Pump Manufacturing Company, Chicago, Ill., stressed the need for careful consideration, prior to installation, of the requirements of a filtering and pumping system to handle plating solutions. In addition to filtering, consideration should be given to auxiliary tanks for purification, methods for making additions of chemicals, methods for heating or cooling solutions, and methods for introducing filter aids and purification materials into the system. Numerous questions brought out the best means for the addition of carbon to a filter system for most rapid purification.

S. L. HENN, *Secretary*



Directory of A. E. S. Officers and Research Chairman Branch Secretaries and Research Chairmen

A. E. S. OFFICERS

President.....A. W. LOGOZZO
Nutmeg Chrome Corporation
79 Chapel Street, Hartford 3, Conn.

First Vice-President.....W. J. NEILL
Columbus Metal Products, Inc.
1341 Norton Avenue, Columbus 12, Ohio

Second Vice-President.....C. F. NIXON
Ternstedt Division, G. M. C.
6307 W. Fort Street, Detroit 9, Mich.

Third Vice-President.....F. J. MacSTOKER
25 Princeton St., Garden City, N. Y.

Past President.....S. S. JOHNSTON
Weirton Steel Company, Weirton, W. Va.

Executive Secretary.....A. K. GRAHAM
P. O. Box 168, Jenkintown, Pa.

A. E. S. RESEARCH COMMITTEE

Chairman.....W. M. TUCKER
Eastman Kodak Company, Rochester 4, N. Y.

Secretary.....The Executive Secretary

LOCAL BRANCHES

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Thursday of each month. Secretary-Treasurer, James F. Riegel, 425 S. 18th Street, Allentown, Pa. Research Finance Committee Chairman, G. W. Ward, 212 N. 6th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of October, December, February, and April in Baltimore at the Engineers' Club, and of November, January, March, and May in Washington, D. C., at the Garden House, Dodge Hotel. Secretary, Vernon A. Lamb, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown, 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, H. A. Fudeman, 534 W. Ferry Street, Buffalo 13, N. Y. Research Finance Committee Chairman, B. P. Fortim, 200 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph St. Secretary-Treasurer, J. M. Andrus, 3701 Ravenswood Avenue, Chicago 13, Ill. Research Finance Committee Chairman, Clyde Kelly, 740 W. Englewood, Chicago 21, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, H. Roper Davis, 6005 Yosemite Drive, Cincinnati 12, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Cleveland, Ohio. Research Finance Committee Chairman, E. C. Friedl, c/o du Pont Company, 1335 Guardian Building, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Nathan L. Koslin, 2641 Cleveland Avenue, Columbus 11, Ohio.

DAYTON meets first Monday of each month in Engineers Club. Secretary, Richard M. Clinchens, 701 W. Stewart Street, Dayton 8, Ohio. Research Finance Committee Chairman, C. W. Powell, 3112 Princeton Drive, Dayton 6, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, Mr. F. J. Darling, 3366 College Avenue, N. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Putte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH. Secretary, William G. Finlay, c/o The M. & Y. Products Limited, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Mr. Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary, H. Smith, 335 Whittier Place, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. F. Strefling, 1423 Kelsey Avenue, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Chester W. Smith, c/o Superior Metal Company, Bethlehem, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway West, Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Scully's Restaurant. Secretary, Myron H. Orbaugh, c/o Bone Engineering & Tool Company, 701 W. Broadway, Glendale 4, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Lousiville. Secretary-Treasurer, Stanley J. Beyer, c/o Hart Products, 915 E. Kentucky Street, Louisville 4, Ky. Research Finance Committee Chairman, Garland Logsdon, 1519 Central Avenue, Louisville, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Hon. Secretary-Treasurer, John J. Dale, c/o Defense Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, Harry J. Krueger, 1333 S. 71st Street, Milwaukee 14, Wis. Research Finance Committee Chairman,

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, George R. King, P. O. Box 29, Montreal 30, Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets first and third Friday of each month at 8 P. M. in Hotel Robert Treet. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn. Research Finance Committee Chairman, Henry B. Smith, c/o R. Wallace & Sons, Wallingford, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I., N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Al Hirsch, 1945 W. Airdrie Street, Philadelphia 40, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary-Treasurer, E. J. Smith, Chem. Dev. & Res. Lab., Weirton Steel Co. Weirton, W. Va Research Finance Committee Chairman, R. A. Woofter, 42 Hiland Ave., Emsworth, Pittsburgh 2, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary, Irving H. Eastman, 79 Spofford Road, Lakewood 5, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Ave., Attleboro, Mass.

ROCHESTER meets third Monday of each month in Ukranian-American Club. Secretary, Gordon W. MacDonald, North Bergen Road, R. D. No. 1, Bergen, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Spring Creek Road, Rockford, Ill. Research Finance Committee Chairman, Al Overbie, c/o National Lock Company, Rockford, Ill.

SAGINAW VALLEY meets for dinner at 7:00 P. M. and meeting at 8:00 P. M. at Rollie McNivens, Frankenmuth, Mich., second Wednesday of each month, September through May. Secretary-Treasurer, R. A. Nyquist, c/o Bay Manufacturing Division, Morton Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, Ray Friend, 1435 Howard Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester, St. Louis, Mo.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, John J. Meehan, 1345 16th Avenue, Apt. 4, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary, William Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, James Laing, 93 Woodbridge Street, South Hadley, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willamansett, Mass.

SYDNEY, AUSTRALIA. Secretary-Treasurer, T. O. Kolts 7 King Street, Newtown, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Hotel Syracuse. Secretary, Kenneth Parnell, c/o Brown-Lipe-Chapin Division, General Motors Corporation, Syracuse, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio. Research Finance Committee Chairman, William Russell, 7th Street at Dixie Highway, Perrysburg, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, R. Stevens, c/o Bryden Brass Company, 927 Dufferin Street, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 316 Builders Exchange, Minneapolis 2, Minn. Research Finance Committee Chairman, Gunnar Deedon, 3650 47th Avenue S., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, Anthony Maz, c/o Risdon Manufacturing Company, Waterbury, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, D. E. Paton, c/o Sydenham Trading Company, Ltd., Wallaceburg, Ontario, Canada.

Advertising Index

ACME MANUFACTURING COMPANY, INC. 67
Agency: Rex Dye
ADAMS ENGINEERING COMPANY 78
Agency: Harry M. Frost Company
ALLIED RESEARCH PRODUCTS, INC. 6
Agency: Emery Advertising Corporation
ALSOP ENGINEERING CORPORATION 100
AMERICAN BRASS COMPANY, THE 8
Agency: Kenyon & Eckhardt, Inc.
AMERICAN CHEMICAL PAINT COMPANY 30
Agency: May Advertising Company
AMERICAN ELECTROPLATERS' SOCIETY 71

BAKER, M. E., COMPANY 81
BELKE MANUFACTURING COMPANY 14
Agency: Allbright Associates
BETTER FINISHES & COATINGS, INC. 34
Agency: James J. McMahon, Inc.
BLAKESLEE, G. S., & COMPANY 89
Agency: Lauesen & Salomon

CHEMCLEAN PRODUCTS CORPORATION 52, 89
CHEMICAL CORPORATION, THE 75
Agency: William B. Remington, Inc.
CHEMSTEEL CONSTRUCTION COMPANY, INC. ... 7
Agency: Smith, Taylor & Jenkins, Inc.
CODMAN, F. L. & J. C., COMPANY 21
Agency: Sanderson Brothers
COWLES CHEMICAL COMPANY, THE 11
Agency: The Bayless-Kerr Company

DARCO CORPORATION 92
Agency: The Aitkin-Kynett Company
DU-LITE CHEMICAL CORPORATION, THE 26
Agency: Manternach, Inc.

ENTHONE, INCORPORATED 3
Agency: Peck Brothers

GREEN, W., ELECTRIC COMPANY, INC. 69, 70
Agency: Shappe-Wilkes, Inc.
GUMM, FREDERICK, CHEM. CO., INC. ..... Second Cover

HAMMOND MACHINERY BUILDERS, INC. 93
Agency: Johnson Printing Equipment Co., Adv. Div.
HANSON-VAN WINKLE-MUNNING CO. ... Fourth Cover
Agency: O. S. Tyson & Company, Inc.
HARRISON AND COMPANY, INC. 86
HARSHAW CHEMICAL COMPANY, THE 24
HOLLAND, J., & SONS, INC. 73
Agency: Norman D. Waters & Associates, Inc.
HULL, R. O., & COMPANY, INC. 23
Agency: Ralph M. French Advertising

INDUSTRIAL FILTER & PUMP MFG. CO. 4
Agency: The Advertising Corporation
INTERNATIONAL NICKEL COMPANY 15
Agency: Marschalk & Pratt Company

KOCOUR COMPANY 75
KUSHNER, JOSEPH B. 74
Agency: Philip Ritter Advertising Agency

LAND, L. J., INC. 74
LASALCO, INCORPORATED 31
Agency: Charles W. Bolan, Advertising
LEA MANUFACTURING COMPANY 50-51
Agency: Sanger-Funnell, Inc.
L'HOMMEDIEU, CHARLES F., & SONS CO. 17

MAC DERMID, INCORPORATED ..... Third Cover
Agency: Ad-Co of New England
MAGNUSON PRODUCTS CORPORATION 72
Agency: George Wilfred Wright
MEAKER COMPANY, THE 10
Agency: The Advertising Corporation
METALLURGICAL PRODUCTS COMPANY 77
Agency: The Harris D. McKinney Organization
MICHIGAN CHROME & CHEMICAL CO. 87
MILLER, J. C., COMPANY 29
Agency: James Philip Reed Advert'sing Agency
MINNESOTA MINING & MFG. COMPANY 13
Agency: Batten, Barton, Durstine & Osborn, Inc.
MURRAY-WAY CORPORATION 27
Agency: F. B. Hubert Advertising Counsel
MUTUAL CHEMICAL CO. OF AMERICA 28
Agency: The House of J. Hayden Twiss

NELSON CHEMICALS CORPORATION 82

OAKITE PRODUCTS, INC. 76
Agency: Rickard & Company, Inc.

PARKER, WILLIAM, COMPANY 79
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plating

January 1, 1950

Dear Reader:

One problem of the technical man is how to preserve useful information in available form. One phase of that problem will be dealt with in an article in a forthcoming issue.

Another phase has to do with the physical size of technical and scientific journals. He who subscribes to a number of them soon has a real storage problem on hand. One solution is to tear out each article of interest, staple it together, and put it in the file. Hence we have taken care not to back one article with another.

A number of our readers want to bind each year's issues into book form. However, the cost of binding is high. For that reason we have obtained separate binders which will be announced soon. Some readers, however, object to the bulk of such volumes; they want to bind only the technical articles.

Beginning with this issue we will make special effort to concentrate all articles in the middle of the "book". For mechanical reasons we do not expect to succeed 100 per cent, but we hope for substantial improvement.

The index to the 1949 issues will be found in this number. It is detachable and may be assembled with previous indexes, glued into the back of the December, 1949 issue, or bound with the 1949 volume as desired.

Sincerely,

Gustaf Soderberg

Future Meetings

CHICAGO BRANCH, A. E. S. Annual Educational Session (2 P. M.) and Banquet (7 P. M.) in Stevens Hotel on Saturday, January 14.

PLANT MAINTENANCE SHOW AND CONFERENCE in the Auditorium, Cleveland, Ohio, on January 16–19, 1950.

GRAND RAPIDS BRANCH, A. E. S. 12th Annual Educational Session (2 P. M.) and Dinner-Dance (7 P. M.) in Pantlind Hotel on Saturday, January 28.

DAYTON BRANCH, A. E. S. 5th Annual Educational Session (1:30 P. M.) and Dinner-Dance (6:15 P. M.) in Hotel Biltmore on Friday, February 24.

AMERICAN SOCIETY FOR TESTING MATERIALS Committee Week and Spring Meeting in Hotel William Penn, Pittsburgh, Pa., on February 27–March 3, 1950.

NATIONAL PRODUCTION EXPOSITION of the Chicago Technical Societies Council in Stevens Hotel, April 4–8, 1950, 1:00–10:00 P. M.

THE ELECTROCHEMICAL SOCIETY, 97th Meeting in Statler Hotel, Cleveland, Ohio on April 19–22.

AMERICAN ELECTROPLATERS' SOCIETY 37th Annual Convention and the 4th International Conference on Electrodeposition in Statler Hotel, Boston, Mass., on June 12–15, 1950.

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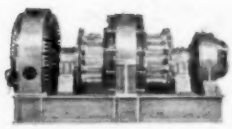
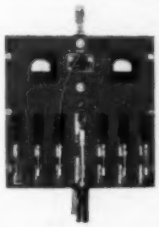


To insure trouble-free commutation in low-voltage generators you should look for such construction features as fully insulated brush holders and rigging... copper pig-tail bar which eliminates current passage thru springs and fingers, and which in turn increases brush life... copper graphite brushes to provide optimum commutator efficiency... moulded-in "equaload" shunts to distribute brush load equally, reduce resistance. Bulletin No. G-102 describes these and other features inherent in all H-VW-M Low Voltage Generators.



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You can get more "mileage" out of buffs by remembering that buffs cost more than compounds and it's the compound that should do the work. Therefore, be sure and select the right compound ... one specifically designed for the particular cutting or coloring job so that the compound does the work and not the buff. H-VW-M makes *all* types ... hand or automatic, bar or liquid ... fully described in Bulletin No. BC-104.

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